YAMAHA
YAMAHA MOTOR CO., LTD.

YAMAHA NETWORK BOARD RCX series

PROFIBUS

User's Manual

ENGLISH E

YAMAHA MOTOR CO., LTD.
IM Operations
882 Soude, Naka-ku, Hamamatsu, Shizuoka 435-0054.Japan
URL http://www.yamaha-motor.jp/robot/index.html

E87-Ver. 1.07

Introduction

Thank you for purchasing the PROFIBUS compatible module. This PROFIBUS compatible module is an option module that allows the YAMAHA robot controller RCX series to be connected as a PROFIBUS system slave module.

The robot controller explained in this manual refers to the RCX series.
This manual describes the flow of operations from wiring the PROFIBUS compatible module to programming, and includes setting examples.

Refer to the respective product manuals for details on other devices such as connecting the master module and sequence programming.
Refer to the controller user's manual and programming manual supplied with the YAMAHA robot controller for details on operating the robot controller and on the robot program.

Applicable controllers: RCX240, RCX141, RCX142, RCX40, RCX221 and RCX222

Model names as used in this manual include the following controllers.

RCX240: Includes RCX240, RCX141, RCX142 and RCX40 (4-axis controllers)
RCX14x: Includes RCX141, RCX142 and RCX40 (4-axis controllers excluding RCX240)*
RCX22x: Includes RCX221 and RCX222 (2-axis controllers)

* Here, "RCX14x" does not include RCX240 and is used when there is a difference between the RCX240 and other 4-axis controllers due to differences in software versions.

● NOTE
The master module explained in this manual is based on the SIEMENS SIMATIC S7-300 series. If the explanations differ from other brands, refer to the manual for the product being used.

SIMATIC is a registered trademark of PLC (programmable logic controller) manufactured by SIEMENS AG, Germany.

Safety Precautions (Always read before starting use)

Always read this manual, the robot controller user's manual and programming manual before using this product. Take special care to safety, and correctly handle the product. The cautions given in this manual are related to this product. Refer to the robot controller user's manual for details on the cautions to be taken with the robot controller system using this product.
* The safety precautions are ranked as “WARNING” and “CAUTION” in this manual.

WARNING
Failure to follow WARNING instructions could result in serious injury or death to the operator or person servicing the product.

CAUTION
Failure to follow CAUTION instructions may result in injury to the operator or person servicing product, or damage to the product or peripheral equipment.

NOTE
Explains the key point in the operation in a simple and clear manner.

Note that some items described as “CAUTION” may lead to serious results depending on the situation. In any case, important information that must be observed is explained. Store this manual where it can be easily referred to, and make sure that it is delivered to the end user.

PROFIBUS is a registered trademark of PROFIBUS International.

[Precautions for design]

WARNING

- **Refer to the PROFIBUS system Master Module User's Manual and this manual for details on the state of the PROFIBUS system and robot controller when a communication error occurs with the PROFIBUS system, etc.**
  Configure an interlock circuit in the sequence program so that the system, including the robot controller will work safely using the communication status information.
- **The SAFETY connector of the robot controller has an emergency stop terminal to trigger emergency stop. Using this terminal, prepare a physical interlock circuit so that the system including the robot controller will work safety.**

CAUTION

- ***The control line and communication cable must not be bound with or placed near the main circuit or power line. Separate these by at least 100mm. Failure to observe this could lead to malfunctions caused by noise.***
- ***On the RCX240, the dedicated input of STD. DIO connector provided on the controller will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled. On the RCX22x, the dedicated input of STD. DIO connector will be disabled, but the interlock signal (DI 11) in SAFETY connector enabled.***

[Precautions for installation]

WARNING

- **Always crimp, press-fit or solder the connector wire connections with the maker-designated tool, and securely connect the connector to the module.**
- **Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to shut off all phases could lead to electric shocks or product damage.**

CAUTION

- ***Use the robot controller within the environment specifications given in the manual.***
  Use in an environment outside the environment specification range could lead to electric shocks, fires, malfunctioning, product damage or deterioration.
- ***Install the PROFIBUS compatible module into the robot controller, and securely fix with screws.***
- ***Never directly touch the conductive sections or electronic parts other than the rotary switch on the PROFIBUS compatible module.***
- ***Never directly touch the conductive sections or electric parts inside the controller.***
- ***Accurately connect each connection cable connector to the mounting section. Failure to observe this could lead to malfunctions caused by a connection fault.***

[Precautions for wiring]

WARNING

- **Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to shut off all phases could lead to electric shocks or product damage.**
- **Always install the terminal covers enclosed with the product before turning ON the power or operating the product after installation or wiring work. Failure to install the terminal cover could lead to malfunctions.**

CAUTION

- ***Tighten the terminal screws within the specified torque range. A loose terminal screw could lead to short-circuiting or malfunctioning. If the terminal screw is too tight, short-circuiting or malfunctioning could occur due to screw damage.***
- ***Make sure that foreign matter, such as cutting chips or wire scraps, do not enter the robot controller.***
- ***The communication cables connected to the PROFIBUS compatible module must be placed in a conduit or fixed with a clamp. If the cable is not placed in a conduit or fixed with a clamp, the module or cable could be damaged by the cable shifting, movement or unintentional pulling leading to malfunctioning caused by an improper cable connection.***
- ***Do not disconnect the communication cable connected to the PROFIBUS compatible module by pulling on the cable section. Loosen the screws on the connector, and then disconnect the cable. Pulling on the cable fixed with screws could lead to module or cable damage, or malfunctioning caused by an improper cable connection.***

[Precautions for starting and maintenance]

WARNING

- **Do not touch the terminals while the power is ON. Failure to observe this could lead to malfunctioning.**
- **Always shut off all phases of the power supply externally before cleaning or tightening the terminal screws. Failure to shut off all phases could lead to electric shocks, product damage or malfunctioning. A loose screw could lead to dropping, short-circuiting or malfunctioning. If the screw is too tight, short-circuiting or malfunctioning could occur due to screw damage.**
- **Never disassemble or modify any of the robot controller modules. Failure to observe this could lead to trouble, malfunctioning, injuries or fires.**
- **Always shut off all phases of the power supply externally before installing or removing the PROFIBUS compatible module. Failure to shut off all phases could lead to robot controller trouble or malfunctioning.**
- **When using the robot controller with the PROFIBUS compatible module mounted, always mount the enclosed ferrite core for noise measures on the power cable as close to the robot controller as possible. Failure to mount this ferrite core could lead to malfunctioning caused by noise.**

CAUTION

The PROFIBUS system may not function properly if the master module and robot controller power are turned ON simultaneously. Always turn the robot controller power ON after turning ON the power for the master module ON.

[Precautions for disposal]

CAUTION

Dispose of this product as industrial waste.

This manual does not guarantee the implementation of industrial rights or other rights, and does not authorize the implementation rights. YAMAHA shall not be held liable for any problems regarding industrial rights that occur through the use of the contents given in this manual.

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Warranty

For information on the warranty period and terms, please contact our distributor where you purchased the product.

This warranty does not cover any failure caused by:

1. Installation, wiring, connection to other control devices, operating methods, inspection or maintenance that does not comply with industry standards or instructions specified in the YAMAHA manual;
2. Usage that exceeded the specifications or standard performance shown in the YAMAHA manual;
3. Product usage other than intended by YAMAHA;
4. Storage, operating conditions and utilities that are outside the range specified in the manual;
5. Damage due to improper shipping or shipping methods;
6. Accident or collision damage;
7. Installation of other than genuine YAMAHA parts and/or accessories;
8. Modification to original parts or modifications not conforming to standard specifications designated by YAMAHA, including customizing performed by YAMAHA in compliance with distributor or customer requests;
9. Pollution, salt damage, condensation;
10. Fires or natural disasters such as earthquakes, tsunamis, lightning strikes, wind and flood damage, etc;
11. Breakdown due to causes other than the above that are not the fault or responsibility of YAMAHA;

The following cases are not covered under the warranty:

1. Products whose serial number or production date (month & year) cannot be verified.
2. Changes in software or internal data such as programs or points that were created or changed by the customer.
3. Products whose trouble cannot be reproduced or identified by YAMAHA.
4. Products utilized, for example, in radiological equipment, biological test equipment applications or for other purposes whose warranty repairs are judged as hazardous by YAMAHA.

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Chapter 1 Outline

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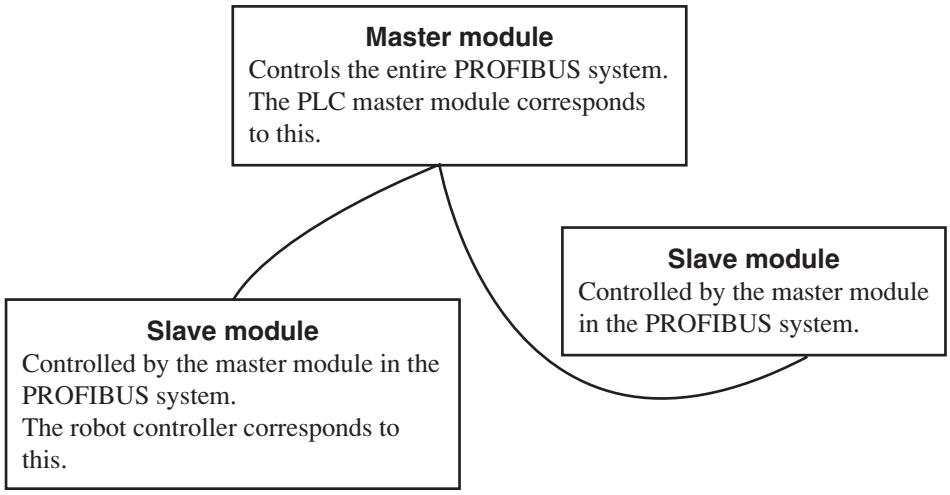
MEMO

1. Features

The PROFIBUS system is a system used to connect the robot controller or scattered input/output modules, etc., with dedicated cables, and to control these modules from the master module.
The PROFIBUS system allows wiring to be reduced.


Master module
Controls the entire PROFIBUS system.
The PLC master module corresponds to this.
Slave module
Controlled by the master module in the PROFIBUS system.
Slave module
Controlled by the master module in the PROFIBUS system.
The robot controller corresponds to this.

NOTE
On the RCX240, the dedicated input of STD. DIO connector provided on the controller will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled. On the RCX22x, the dedicated input of STD. DIO connector will be disabled, but the interlock signal (DI 11) in SAFETY connector enabled.

[Wiring saving]

One dedicated cable (5-wire) is used to connect the robot controller and PLC. This allows the entire system wiring to be reduced.

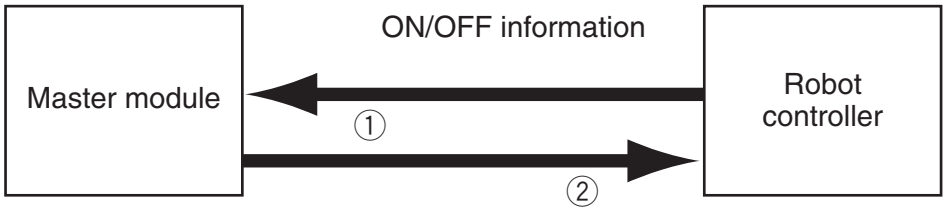
[Emulated serialization on parallel DIO]

By making the robot controller's internal settings without using a robot program, the various I/O devices, such as the sensors and relays mounted on the robot controller's parallel I/O can be controlled from the PLC as if they were PROFIBUS system I/O devices.

CAUTION
An emergency stop terminal for hardwire is provided in the SAFETY connector on the robot controller. In the case of the RCX240, when the PROFIBUS system is used while STD. DIO is not used (external DC 24V power supply is not used), the Board condition (external 24V monitor control) of system parameters must be set invalid. If it is left valid, the STD. DIO interlock signal is enabled causing an error in the robot operation commands.

2. Mechanism

The mechanism of communication is explained in this section to provide an understanding of how the robot controller and master module operate via the PROFIBUS system.



① The robot controller's ON/OFF information is sent to the master module via the network (PROFIBUS system cable).

② The master module's ON/OFF information is set to the robot controller via the network (PROFIBUS system cable).

* The robot controller monitors the ON/OFF information at a 10ms cycle.

* The ON/OFF information consists of two words each of dedicated I/O words, 14 words each of general-purpose I/O words as word information, and 16 points each of dedicated I/O points, 96 points each of general-purpose I/O points as bit information.

If the following is executed with the robot program in the robot controller, the bit information will be sent to the master module via the PROFIBUS system by ①.

SO (20)=1

Conversely, if the following is executed with the robot program, the bit information received from the master module via the PROFIBUS system will be monitored by ②, and the robot controller will wait for the ON information.

WAIT SI (20)=1

If the following is executed with the robot program in the robot controller, the word information will be sent to the master module via the PROFIBUS system by ①.

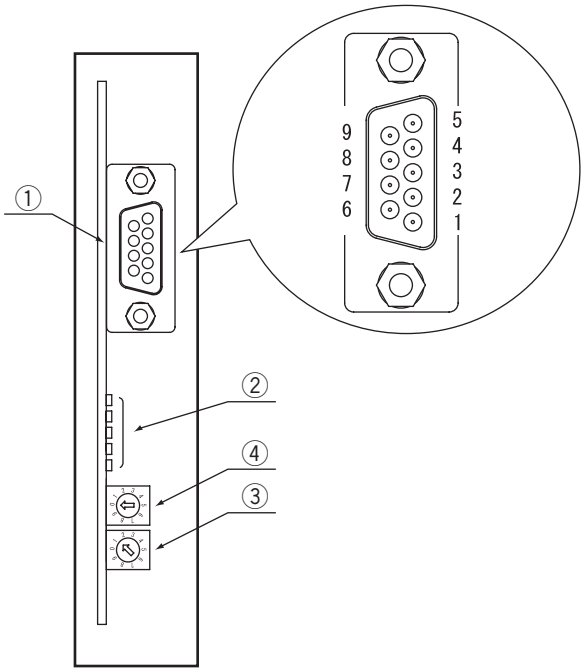
SOW (2)= 256

Conversely, if the following is executed with the robot program, the word information received from the master module via the PROFIBUS system will be substituted in integer variable A% by ②.

A% = SIW (3)

3. Names of each part on the PROFIBUS compatible module

The part names of the PROFIBUS compatible module installed in the robot controller are described in this section. The PROFIBUS compatible module is installed into an optional slot in the robot controller.



Front of the unit

① PROFIBUS-DP connector

This is used to connect the PROFIBUS system cable. Follow the pin assignment below to avoid miswiring.

Pin No.	Description
1	No connection
2	No connection
3	Signal
4	RTS
5	GND
6	+5V
7	No connection
8	Signal
9	No connection
Metal part, screw part	For protective ground

② Transmission monitor LED

The status in the PROFIBUS system is indicated with ON, OFF and flickering status of five LEDs. These terminals are “DATA-EX”, “SD” “RD” “ERR” and “RUN” from the top.

③ Station address setting switch (LSB: 1st digit)

This is the rotary switch for setting the robot controller station address in the PROFIBUS system. The 1st digit of the station address is set with this switch.

④ Station address setting switch (MSB: 2nd digit)

This is the rotary switch for setting the robot controller station address in the PROFIBUS system. The 2nd digit of the station address is set with this switch.

4. Assignment of PROFIBUS compatible I/O

NOTE
SIW(n) and SOW(n) are handled as numerical data of word with no sign. SID(n) and SOD(n) are handled as numerical data of double words with a sign.

NOTE
On the RCX240, the dedicated input of STD. DIO connector provided on the controller will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled. On the RCX22x, the dedicated input of STD. DIO connector will be disabled, but the interlock signal (DI 11) in SAFETY connector enabled.

The I/O expressions in the robot controller's program language and the I/O expressions in the slave module differ. The correspondence is shown below.

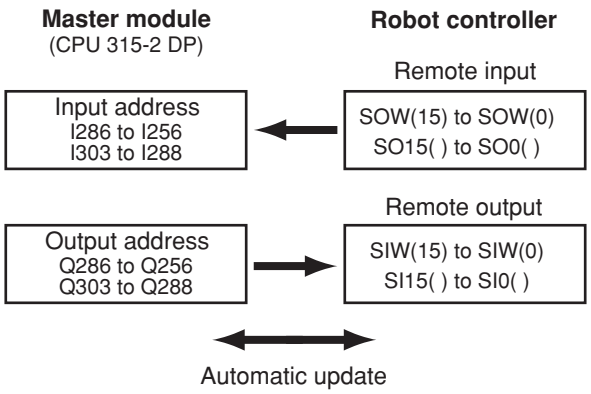
Output from robot controller			Input to robot controller		
Program language		Master module	Program language		Master module
	SOW(0)*3	Im		SIW(0)*3	Qn
	SOW(1)*3	Im+2		SIW(1)*3	Qn+2
SOD(2)	SOW(2)	Im+4	SID(2)	SIW(2)	Qn+4
	SOW(3)	Im+6		SIW(3)	Qn+6
SOD(4)	SOW(4)	Im+8	SID(4)	SIW(4)	Qn+8
	SOW(5)	Im+10		SIW(5)	Qn+10
SOD(6)	SOW(6)	Im+12	SID(6)	SIW(6)	Qn+12
	SOW(7)	Im+14		SIW(7)	Qn+14
SOD(8)	SOW(8)	Im+16	SID(8)	SIW(8)	Qn+16
	SOW(9)	Im+18		SIW(9)	Qn+18
SOD(10)	SOW(10)	Im+20	SID(10)	SIW(10)	Qn+20
	SOW(11)	Im+22		SIW(11)	Qn+22
SOD(12)	SOW(12)	Im+24	SID(12)	SIW(12)	Qn+24
	SOW(13)	Im+26		SIW(13)	Qn+26
SOD(14)	SOW(14)	Im+28	SID(14)	SIW(14)	Qn+28
	SOW(15)	Im+30		SIW(15)	Qn+30
SO0(7 to 0)*1		Im+32.7 to Im+32.0	SI0(7 to 0)*1		Qn+32.7 to Qn+32.0
SO1(7 to 0)*1		Im+33.7 to Im+33.0	SI1(7 to 0)*1		Qn+33.7 to Qn+33.0
SO2(7 to 0)		Im+34.7 to Im+34.0	SI2(7 to 0)		Qn+34.7 to Qn+34.0
SO3(7 to 0)		Im+35.7 to Im+35.0	SI3(7 to 0)		Qn+35.7 to Qn+35.0
SO4(7 to 0)		Im+36.7 to Im+36.0	SI4(7 to 0)		Qn+36.7 to Qn+36.0
SO5(7 to 0)		Im+37.7 to Im+37.0	SI5(7 to 0)		Qn+37.7 to Qn+37.0
SO6(7 to 0)		Im+38.7 to Im+38.0	SI6(7 to 0)		Qn+38.7 to Qn+38.0
SO7(7 to 0)		Im+39.7 to Im+39.0	SI7(7 to 0)		Qn+39.7 to Qn+39.0
SO10(7 to 0)		Im+40.7 to Im+40.0	SI10(7 to 0)		Qn+40.7 to Qn+40.0
SO11(7 to 0)		Im+41.7 to Im+41.0	SI11(7 to 0)		Qn+41.7 to Qn+41.0
SO12(7 to 0)		Im+42.7 to Im+42.0	SI12(7 to 0)		Qn+42.7 to Qn+42.0
SO13(7 to 0)		Im+43.7 to Im+43.0	SI13(7 to 0)		Qn+43.7 to Qn+43.0
SO14(7 to 0)		Im+44.7 to Im+44.0	SI14(7 to 0)		Qn+44.7 to Qn+44.0
SO15(7 to 0)		Im+45.7 to Im+45.0	SI15(7 to 0)		Qn+45.7 to Qn+45.0
———		Im+47.7 to Im+46.0 *2	———		Qn+47.7 to Qn+46.0 *2

I, Q : Input/output address.
m, n : Start address assigned by hardware configuration.

Caution)
****1: Has a meaning in the robot controller's internal process as a dedicated input/output. This cannot be used as a general-purpose input/output in the robot program.***
****2: This is a reserved area.***
****3: Has a meaning in the robot controller internal process as a dedicated command region. This cannot be used as a general-purpose input/output in the robot program.***

An example of the I/O information flow in the robot controller (slave module) is shown below. The buffer memory of the master module into which the I/O information is stored differs depending on the PLC type, assignment method, etc. Refer to the PLC manual for details.

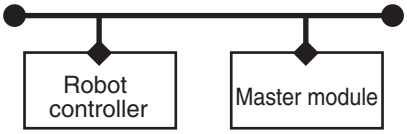
Example :



5. Shift of PROFIBUS system connection status and robot controller status

Always start the PROFIBUS system specification robot controller in the servo OFF state after the power is turned ON.

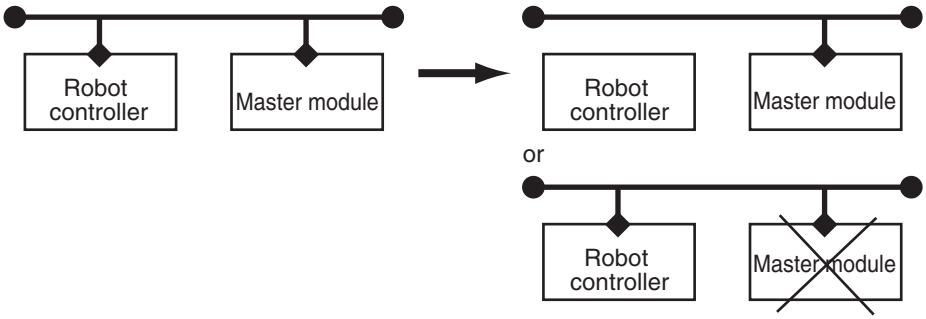
① Normal state of PROFIBUS system connection when robot controller power is turned ON



- Emergency stop/interlock signal in PROFIBUS system are valid.
- When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the PROFIBUS system.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid. (RCX240)
- Interlock signal in SAFETY connector is valid. (RCX22x)
- When the Board condition (external 24V monitor control) of system parameters is set valid while SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX240)
- When SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX22x)

* The signals in the PROFIBUS system are sent and received.

② Shift from PROFIBUS system normal connection state to PROFIBUS system erroneous connection state



- Emergency stop input turns off with SI (00) in the robot controller.
- Service mode input turns off with SI (02) in the robot controller.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid. (RCX240)
- Interlock signal in SAFETY connector is valid. (RCX22x)
- When the Board condition (external 24V monitor control) of system parameters is set valid while SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX240)
- When SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX22x)

* The signals in the PROFIBUS system are not sent or received.

* The “PROFIBUS Link Error” is added to the error history in the robot controller.

* If the connection to the PROFIBUS system shifts from the normal state to the erroneous state, the PROFIBUS system connection must be returned to the normal state.

* The PROFIBUS system will return when the PROFIBUS system connection is recovered to the normal state.

③ PROFIBUS system erroneous connection state due to following factors when robot controller power is turned ON

- Connection to PROFIBUS system not possible
- Error in master module

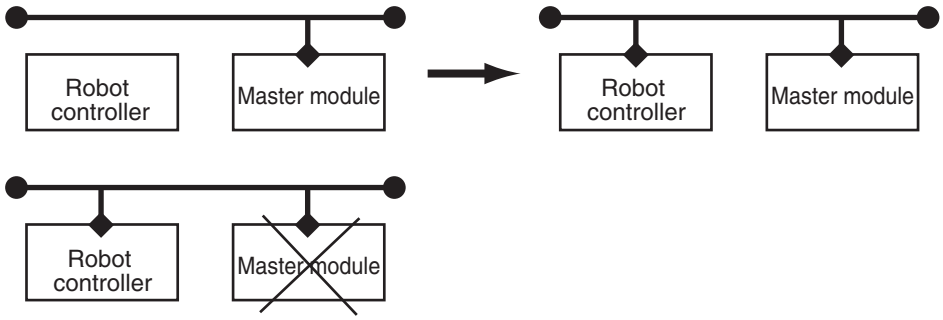
- Emergency stop/interlock signals in PROFIBUS system are invalid.
- When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the PROFIBUS system.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid. (RCX240)
- Interlock signal in SAFETY connector is valid. (RCX22x)
- When the Board condition (external 24V monitor control) of system parameters is set valid while SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX240)
- When SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX22x)

* The signals on the PROFIBUS system cannot be exchanged.
* The “PROFIBUS Link Error” has been added to the error history in the robot controller.

  (A standby state for up to 5 seconds will occur to check the communication.)
* As opposed to the state given in ②, in this state, the emergency stop state by SI (00) is not attained in the controller, so the robot can be operated from the programming box.

  (The robot controller can be started independently when setting up the system, etc.)
* Service mode input signal cannot be invalidated with SI (02) when SAFE mode is enabled, so change the service mode parameter setting in SYSTEM > PARAM mode. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.
* When the connection to the PROFIBUS system is correctly recovered, the system will automatically return to the PROFIBUS system.

④ Transmission from PROFIBUS system erroneous connection state to PROFIBUS correct connection state when robot controller power is turned ON



- PROFIBUS system emergency stop/interlock signals change to valid state.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid. (RCX240)
- Interlock signal in SAFETY connector is valid. (RCX22x)
- When the Board condition (external 24V monitor control) of system parameters is set valid while SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX240)
- When SAFE mode is enabled, service mode input signal is made valid with DI(02) in SAFETY connector. (RCX22x)

* The signals in the PROFIBUS system can be sent and received.

* When service mode parameter setting in SYSTEM > PARAM mode has been changed while SAFE mode is enabled, make the service mode parameter setting again. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.

* The PROFIBUS system will return when the PROFIBUS system connection is recovered to the normal state.

MEMO

Chapter 2 Connection

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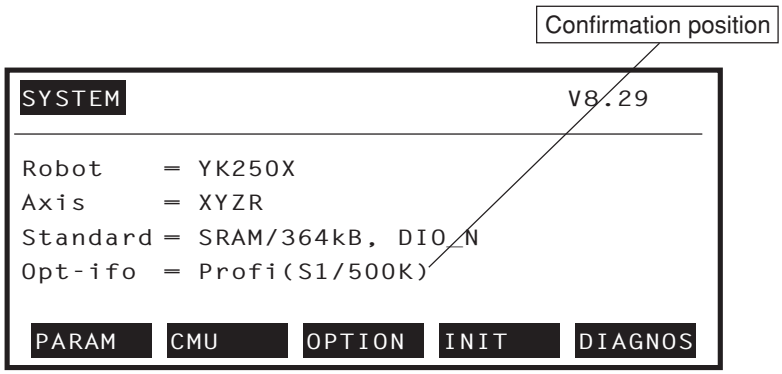
MEMO

1. Confirming the PROFIBUS compatible module settings

When using the PROFIBUS system specification robot controller, the PROFIBUS compatible module's station address and communication speed setting can be confirmed from the programming box (RPB for RCX22x and RCX240 or MPB for RCX14x; hereinafter called "MPB/RPB").

- When connecting PROFIBUS compatible module to existing robot controller
  → Follow the procedures given in section 2., and change the settings for the PROFIBUS system specifications.
- For PROFIBUS system specification robot controller
  (When robot controller is purchased with PROFIBUS compatible module mounted)
  → Set the station address according to the procedure explained in section 3 of chapter 2.



[Operation]

1. Press the MODE key on the MPB/RPB.

2. Press the F 4 (SYSTEM) key on the MPB/RPB.

3. The display above will appear. The station address and communication speed set for the PROFIBUS system will appear in the parentheses following "Profi" on the screen. The meaning of the above example is shown below.
   S1 :Station address 1
   (Setting range: 1 to 99)
   500K :500Kbps
   * Communication speed is automatically recognized.

⚠ ***CAUTION***
If the robot controller is not connected to the PROFIBUS system or if there is an error in the PROFIBUS system, the error "PROFIBUS Link Error" will appear on the MPB/RPB when the robot controller power is turned ON. The above settings can be confirmed even in this state.

2. Setting to the PROFIBUS system specification controller

When connecting the PROFIBUS compatible module to an existing robot controller, the PROFIBUS compatible module must be installed in the robot controller. Check the PROFIBUS system specifications with the procedure given in section 1.

2.1 Saving the robot controller data

Before installing the PROFIBUS compatible module into the robot controller, be sure to save the data stored in the robot controller into an external memory by using VIP software, etc.

2.2 Installing the PROFIBUS compatible module

Install the PROFIBUS compatible module into the robot controller. Also set the station address for the PROFIBUS compatible module by referring to the procedures in “3. Setting the PROFIBUS compatible module” in chapter 2.

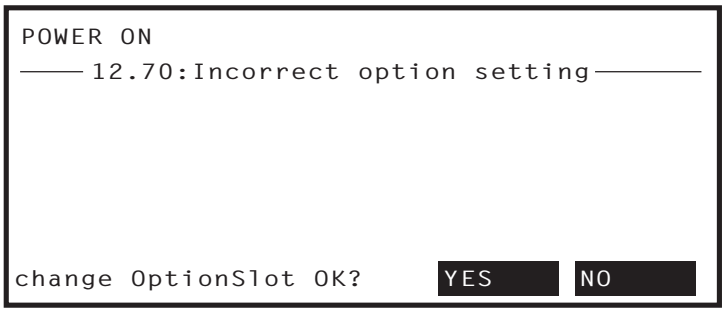
2.3 Response when starting the robot controller

The robot controller will always start up with an “option board setting error” after the PROFIBUS compatible module has been installed. Make the following settings as explained below.

[Procedure]

1. Make connections to all input connectors on the front panel of the robot controller.

2. The following type of question will appear on the MPB/RPB screen, so answer as “YES”.



3. If the controller does not operate properly because of a memory error, etc., load the data saved in step 2.1 into the controller. Refer to the controller user's manual for details on loading the data.

   If the robot controller is not correctly connected with the PROFIBUS system, the message “PROFIBUS Link Error” will appear on the MPB/RPB.

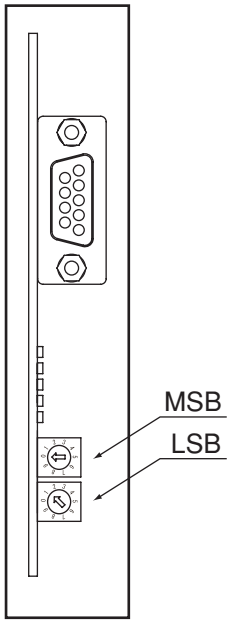
NOTE
Refer to the VIP user's manual for how to load data using the VIP support software.

3. Setting the PROFIBUS compatible module

To connect the PROFIBUS system specification controller to the PROFIBUS system, the station address must be set with the rotary switch on the PROFIBUS compatible module. Carry out the operations explained in section 2.1 to confirm the current station address and communication speed settings.

3.1 Setting the station address

Using the rotary switches MSB and LSB in front of the PROFIBUS compatible module, set the station address of the robot controller in the PROFIBUS system.



Front of the unit

NOTE
The station address for the PROFIBUS system can be set in the range of 1 to 99.

CAUTION
- ***Make sure that the setting is not duplicated with other settings.***
- ***Never directly touch the conductive sections or electronic parts other than the rotary switch on the PROFIBUS compatible module.***
- ***Do not apply impact on the PROFIBUS compatible module.***
- ***Do not place water or conductive matters, etc., which could cause damage near the PROFIBUS compatible module.***
- ***Accurately set the station address.***
- ***Set the station address that was set by the configuration tool.***
- ***Use the configuration tool to set the station address that was set by the rotary switch.***
- ***For the procedure to operate the configuration tool, refer to its operation manual.***

[Procedures]

1. Check the station address of the robot controller in the PROFIBUS system. The station address must be set between 1 and 99.
2. Using a precision Flathead screwdriver, set the 2nd digit of the station address on rotary switch MSB.
3. In the same manner, set the 1st digit on rotary switch LSB.

WARNING
When setting the station address, completely shut off the power supplied to the robot controller.

4. Noise measures

Two ferrite cores must be mounted on the input power cable when connecting to the PROFIBUS system.

4.1 Mounting the ferrite core

Mount two ferrite cores onto the input power cable connected to the input power connector on the front panel of the robot controller.

[Procedures]

1. Mount the two ferrite cores (supplied) onto the input power cable. The ferrite core should be placed as close to the robot controller body as possible.

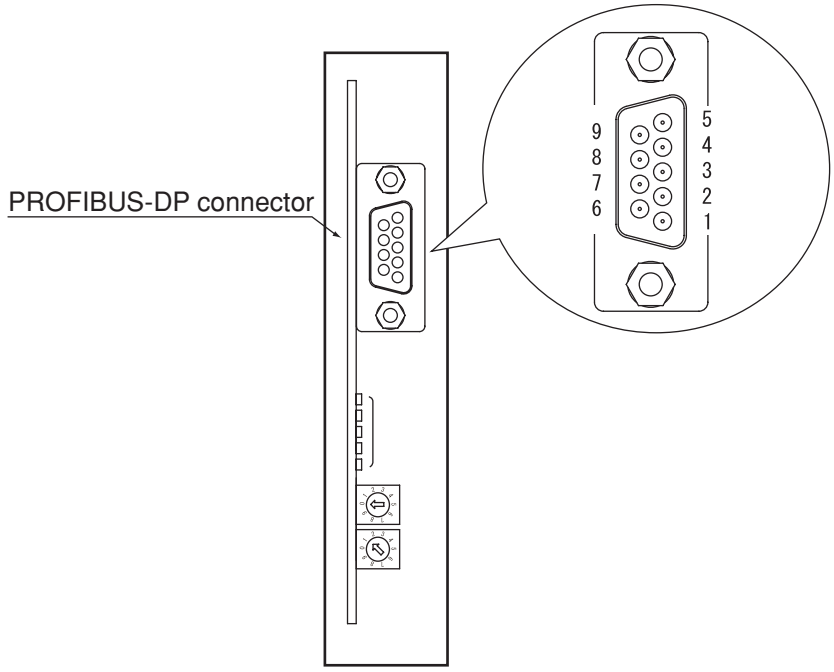
2. Fix the mounted ferrite core with an Insulock tie, etc.

⚠ ***WARNING***
Completely shut off the power supply to the input power cable before starting this work.

⚠ ***CAUTION***
Securely fix the ferrite core. If the ferrite core is not mounted, trouble could occur with the PROFIBUS system operations.

5. Connecting to the PROFIBUS system

The PROFIBUS system cable must be connected to the PROFIBUS compatible module in order to connect to the PROFIBUS system.



⚠ *WARNING*
When setting the station address, completely shut off the power supplied to the robot controller.

5.1 Connecting the cable to the robot controller

Connect the PROFIBUS system cable to the PROFIBUS-DP connector on the PROFIBUS compatible module.

⚠ *CAUTION*
- ***Securely fix the PROFIBUS system cable.***
- ***Carefully carry out the work to valid applying excessive force on the PROFIBUS cable.***
- ***Treat the end of each PROFIBUS system cable with a crimp terminal so that the cable does not dislocate.***
- ***Carefully carry out the work so that the PROFIBUS system cable is not incorrectly wired.***
- ***Refer to the master module instruction manual for details on the PROFIBUS system cable connection.***

[Procedure]

Plug the connector of the PROFIBUS system cable into the PROFIBUS-DP connector on the PROFIBUS compatible module and tighten the two screws on both sides of the connector to fasten securely.

* When the robot controller is an end of the bus, always connect a termination resistor.

5.2 Testing the line from the master module

When connecting the robot controller to the PROFIBUS system, the robot controller must be set as a slave unit on the PROFIBUS system by using the hardware configuration tool. After setting, create a check program and make sure that PROFIBUS communication is performed reliably. For the procedure to operate the configuration tool, refer to its operation manual.
For more details, refer to the master module instruction manual.

⚠ *CAUTION*
If the line test results indicate a correct connection, place the PROFIBUS system cable into a conduit, or fix it with a clamp.

6. Parameter setting for PROFIBUS serial I/O board

NOTE

- *When not using serial I/O boards, set the Board condition parameter (Serial IO parameter for RCX22x) to "INVALID".*
- *When the "Board condition" parameter ("Serial IO" parameter for RCX22x) is set to "INVALID", the dedicated input/output of STD. DIO connector becomes enabled. When the "Board condition" parameter is set to "VALID", the dedicated input (except DI11 for RCX240) of STD. DIO connector becomes disabled.*
- *For remote commands and I/O commands, refer to the command reference manual.*
- *For a description of codes issued from the message output function for SOW(1), refer to "1. Error message" in chapter 9.*
- *When the Remote command & I/O command parameter is set to "VALID", the Output MSG to SOW(1) parameter cannot be set to "VALID". Likewise, when the Output MSG to SOW(1) parameter is set to "VALID", the Remote command & I/O command parameter cannot be set to "VALID".*

The following functions are enabled or disabled by setting the parameters for the PROFIBUS serial I/O board.

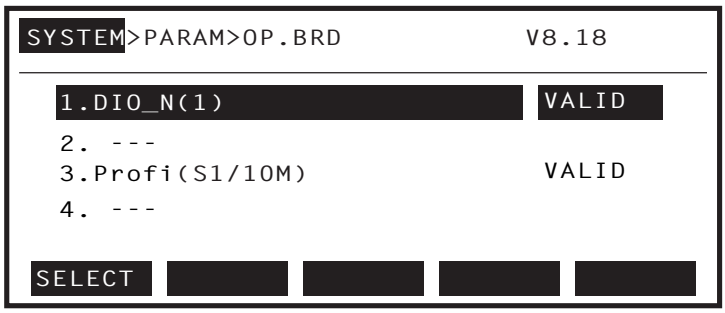
	Parameter	Meaning
1.	[RCX240] Board condition [RCX22x] Serial IO	Enables or disables the serial I/O board. When set to "VALID" the serial I/O can be used. When set to "INVALID" the serial I/O cannot be used.
2.	Remote cmd / IO cmd (SI05)	Enables or disables the functions of remote commands and I/O commands using word information and bit information. When set to "VALID" the remote commands and I/O commands can be used. When set to "INVALID" the remote commands and I/O commands cannot be used. This parameter cannot be set to "VALID" simultaneously with parameter 3.
3.	Output MSG to SOW(1)	Enables or disables the function to send an message number, which is displayed on the MPB/RPB, to word information SOW(1). When set to "VALID" the message number to be displayed on the MPB/RPB will be output. When set to "INVALID" the message number to be displayed on the MPB/RPB will not be output. This parameter cannot be set to "VALID" simultaneously with parameter 2.

6.1 Parameter setting for PROFIBUS serial I/O board

1) Press the [F 1] (PARAM) key in "SYSTEM" mode to enter "SYSTEM>PARAM" mode.

2) Press the [F 5] (OP. BRD) key in "SYSTEM>PARAM" mode to enter the option board parameter setting mode.
The option boards installed in the controller are displayed in order on the MPB/RPB screen.

Fig. 2-6-1

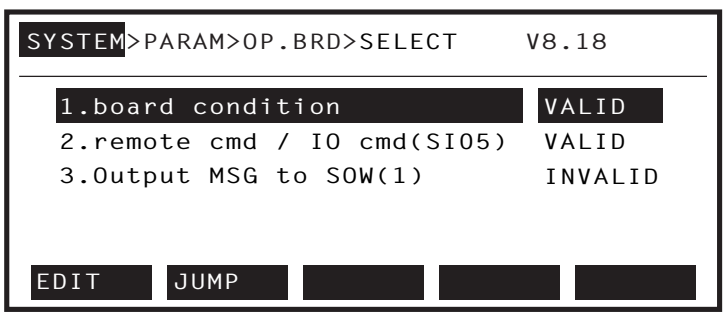


Option boards installed into the option slots are displayed on the MPB/RPB screen.

Type	Display	Meaning
Option DIO	DIO_N(n)	An option DIO board of NPN specifications is installed. The number in parentheses is an ID number.
	DIO_P(n)	An option DIO board of PNP specifications is installed. The number in parentheses is an ID number.
Serial IO	CCLnk(n/m)	A CC-Link unit is installed. Letters in parentheses indicate a station number "n" and a communication speed "m".
	D_Net(n/m)	A DeviceNet unit is installed. Letters in parentheses indicate a MAC ID number "n" and communication speed "m".
	Profi(n/m)	A Profibus unit is installed. Letters in parentheses indicate a Station address "n" and communication speed "m".
Network	E_Net	An Ethernet unit is installed.
YC-Link	YCLnk(Mn)	A YC-Link unit is installed. Letters in parentheses indicate a station number "n".

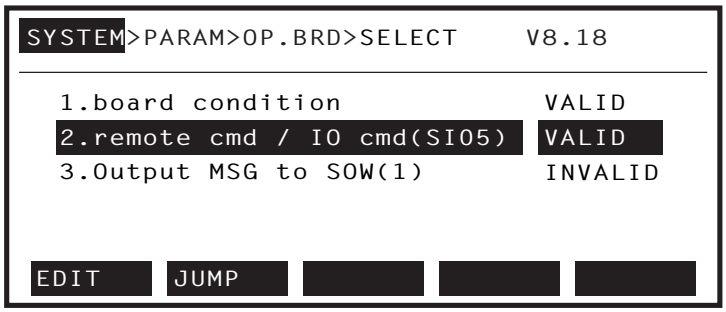
3) In "SYSTEM>PARAM>OP. BRD" mode, select the "Profi" with the cursor (↑/↓) keys and press the [F 1] (SELECT) key.

Fig. 2-6-2



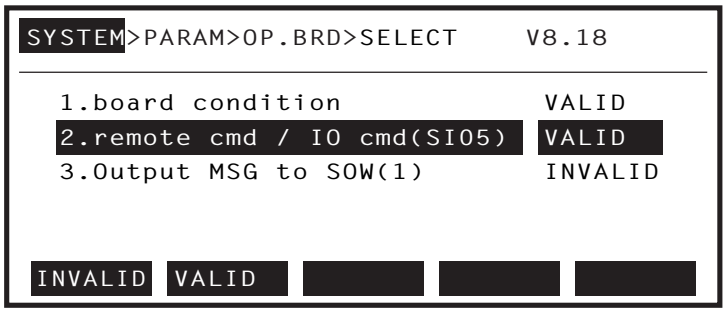
4) Select the parameter with the cursor (↑/↓) keys.

Fig. 2-6-3



5) Press the F 1 (EDIT) key.

Fig. 2-6-4



6) Press the F 1 (INVALID) or F 2 (VALID) key.

7) Press the ESC key to quit the edit mode. To continue setting another parameter, use the cursor (↑/↓) keys to select the parameter.

Chapter 3 Communication

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MEMO

1. State when robot controller power is turned ON

The PROFIBUS system specification robot controller always starts operation in servo OFF state when the power turned ON.

① When connection to PROFIBUS system is correctly established.

The following conditions must be satisfied to correctly connect to the PROFIBUS system:

- The PROFIBUS system cable must be physically connected
- The station address must be correctly set
- The master module is operating normally

When the robot controller is correctly connected to the PROFIBUS system, the normal state will be indicated with the LEDs on the PROFIBUS compatible module.

At this time, the emergency stop signal and interlock signal in the PROFIBUS system will be validated, so both signals must be turned ON in the connection process.

The emergency stop terminal in SAFETY connector is always kept valid. On the RCX22x, the interlock signal in SAFETY connector is also valid. On the RCX240, the interlock signal in STD. DIO connector is left valid unless the Board condition (external 24V monitor control) of system parameters is set invalid.

When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the PROFIBUS system. On the RCX22x, service mode input signal is also made valid with DI(02) in SAFETY connector. On the RCX240, when SAFE mode is enabled, service mode input signal is also made valid with DI(02) in SAFETY connector unless the Board condition (external 24V monitor control) of system parameters is set invalid.

② When connection to PROFIBUS system is incorrectly established

The following causes can be considered a correct connection with the PROFIBUS system cannot be established:

- The PROFIBUS system cable is not physically connected
- The station address is set incorrectly
- The master module is not operating correctly

When incorrectly connected to the PROFIBUS system, an abnormal state will be indicated on the PROFIBUS compatible module's LED. This also occurs when the master module is not operating correctly.

The emergency stop signal and interlock signal in the PROFIBUS system are invalid in this case, so the robot controller can be operated independently. However, if the correct state has been established even once after the robot controller power was turned ON, the robot controller's emergency stop state cannot be canceled without correctly connecting to the PROFIBUS system.

The emergency stop terminal in SAFETY connector is always kept valid. On the RCX22x, the interlock signal in SAFETY connector is also valid. On the RCX240, the interlock signal in STD. DIO connector is left valid unless the Board condition (external 24V monitor control) of system parameters is set invalid.

When SAFE mode is enabled on the RCX22x, service mode input signal is also made valid with DI(02) in SAFETY connector. On the RCX240, when SAFE mode is enabled, service mode input signal is also made valid with DI(02) in SAFETY connector unless the Board condition (external 24V monitor control) of system parameters is set invalid.

Service mode input signal in the PROFIBUS system cannot be invalidated when SAFE mode is enabled, so change the service mode setting system parameters. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.

* For meanings of LED display, see Chapter 4 in this manual.

2. Communication with master module

The method for communicating with the master module by using the robot program when the PROFIBUS system is correctly connected is explained in this section.

2.1 Receiving data

Data is received by reading the master module's output address data with the robot controller's input port.
The correspondence of the master module's output addresses and robot controller input port numbers is shown below.

Master module address	Robot controller input port No.		Master module address	Robot controller input port No.
Qn		SIW(0)	Qn+32.0 to Qn+32.7	SI(00) to SI(07)
Qn+2		SIW(1)	Qn+33.0 to Qn+33.7	SI(10) to SI(17)
Qn+4	SID(2)	SIW(2)	Qn+34.0 to Qn+34.7	SI(20) to SI(27)
Qn+6		SIW(3)	Qn+35.0 to Qn+35.7	SI(30) to SI(37)
Qn+8	SID(4)	SIW(4)	Qn+36.0 to Qn+36.7	SI(40) to SI(47)
Qn+10		SIW(5)	Qn+37.0 to Qn+37.7	SI(50) to SI(57)
Qn+12	SID(6)	SIW(6)	Qn+38.0 to Qn+38.7	SI(60) to SI(67)
Qn+14		SIW(7)	Qn+39.0 to Qn+39.7	SI(70) to SI(77)
Qn+16	SID(8)	SIW(8)	Qn+40.0 to Qn+40.7	SI(100) to SI(107)
Qn+18		SIW(9)	Qn+41.0 to Qn+41.7	SI(110) to SI(117)
Qn+20	SID(10)	SIW(10)	Qn+42.0 to Qn+42.7	SI(120) to SI(127)
Qn+22		SIW(11)	Qn+43.0 to Qn+43.7	SI(130) to SI(137)
Qn+24	SID(12)	SIW(12)	Qn+44.0 to Qn+44.7	SI(140) to SI(147)
Qn+26		SIW(13)	Qn+45.0 to Qn+45.7	SI(150) to SI(157)
Qn+28	SID(14)	SIW(14)		
Qn+30		SIW(15)		

Q : Output address.
n : Start address assigned by hardware configuration.

CAUTION
Always refer to the PLC manual and check the settings for communication with the master module.
SIW(0) and SIW(1) are viewed as dedicated input ports. The robot controller handles these ports as input ports of meaningful data, so do not use them as general-purpose input ports.
Set these ports to "0" in most cases.

When reading the bit information from the master module output address with the robot controller, write the following command in the robot program in the same manner as the DI input port.

WAIT command
Assignment statement

NOTE
The SI statement in the robot language can be defined from SI0 ( ) to SI27 ( ), but the PROFIBUS compatible module accepts from SI0 ( ) to SI15 ( ).

Example :To wait for Qn+34.0 to turn ON
WAIT SI (20) = 1 ..... * The robot program will wait for SI (20) to turn ON.

Example :To read the Qn+34.0 to Qn+34.7 data into variable A
A = SI2 () ..... * The SI2 () data will be converted into a decimal and substituted into variable A. If SI2 () is 7Fh, variable A will be 127.

When reading the word information from the master module's output address with the robot controller, write the following command in the robot program.

Assignment statement

Example :To read the Qn+4 word data into variable B
B = SIW (2) ..... * The SIW (2) data will be substituted into variable B as a decimal. If SIW (2) is 01FFh, variable B will be 511.

NOTE
The word data read with SIW (n) has the uncoded little endian format.
The double word data read with SID (n) has the coded little endian format.

Example :To read the Qn+4 and Qn+6 double word data into variable C
C = SID (2) ..... * The SIW (2) and SIW (3) data will be substituted into variable C as a decimal. If SIW (2) is 0010h and SIW (3) is 0001h, variable C will be 65552.

2.2 Transmitting data

Data is transmitted by writing the robot controller's output port data into the master module's input address.
The correspondence of the master module's input addresses and robot controller output port numbers is shown below.

Master module address	Robot controller output port No.		Master module address	Robot controller output port No.
Im		SOW(0)	Im+32.0 to Im+32.7	SO(00) to SO(07)
Im+2		SOW(1)	Im+33.0 to Im+33.7	SO(10) to SO(17)
Im+4	SOD(2)	SOW(2)	Im+34.0 to Im+34.7	SO(20) to SO(27)
Im+6		SOW(3)	Im+35.0 to Im+35.7	SO(30) to SO(37)
Im+8	SOD(4)	SOW(4)	Im+36.0 to Im+36.7	SO(40) to SO(47)
Im+10		SOW(5)	Im+37.0 to Im+37.7	SO(50) to SO(57)
Im+12	SOD(6)	SOW(6)	Im+38.0 to Im+38.7	SO(60) to SO(67)
Im+14		SOW(7)	Im+39.0 to Im+39.7	SO(70) to SO(77)
Im+16	SOD(8)	SOW(8)	Im+40.0 to Im+40.7	SO(100) to SO(107)
Im+18		SOW(9)	Im+41.0 to Im+41.7	SO(110) to SO(117)
Im+20	SOD(10)	SOW(10)	Im+42.0 to Im+42.7	SO(120) to SO(127)
Im+22		SOW(11)	Im+43.0 to Im+43.7	SO(130) to SO(137)
Im+24	SOD(12)	SOW(12)	Im+44.0 to Im+44.7	SO(140) to SO(147)
Im+26		SOW(13)	Im+45.0 to Im+45.7	SO(150) to SO(157)
Im+28	SOD(14)	SOW(14)		
Im+30		SOW(15)		

I : Input address.
m : Start address assigned by hardware configuration.

CAUTION
Always refer to the PLC manual and check the settings for communication with the master module. SIW(0) and SIW(1) are viewed as dedicated input ports.

When writing the robot controller's bit information into the master module's input address, write the following command in the robot program in the same manner as the DO output port.

SET/RESET command
Assignment statement

NOTE
The SO statement in the robot language can be defined from SO2 ( ) to SO27 ( ), but the PROFIBUS compatible module accepts from SO2 ( ) to SO15 ( ).

Example :To turn Im+34.0 ON
SET SO (20) or SO (20) = 1 .* SO (20) will turn ON.

Example :To write variable A data into Im+34.0 to Im+34.7
SO2 () = A .....* The variable A data will be converted into a binary and substituted in SO 2(). If variable A is 127, SO2 () will be 7Fh.

When writing the robot controller word information into the master module's input address, write the following command in the robot program.

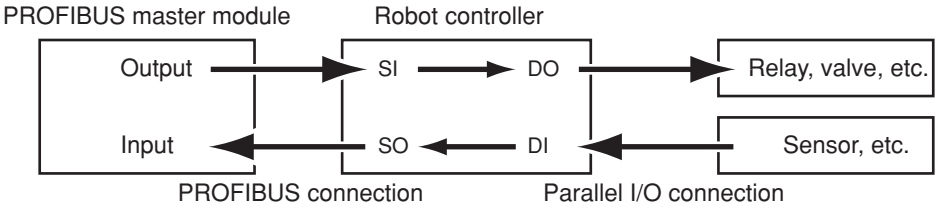
Assignment statement

Example :To write 512 into Im+4 as word data
SOW (2) = 512 .....* 512 is substituted in SOW (2), and SOW (2) becomes 0200h.

NOTE
The word data written with SOW (n) has the uncoded little endian format. The double word data written with SOD (n) has the coded little endian format.

Example :To write 69905 as the double word data for Im+4 and Im+6
SOD (2) = 69905 .....* 69905 is substituted in SOD (2), SOW (2) becomes 1111h and SOW (3) becomes 0001h.

The robot controller's parallel input data can be transferred to the serial output data regardless of the robot program. Likewise, the robot controller's serial input data can be transferred to the parallel output data. Using this function, I/O devices such as a sensor or relay connected in parallel to the robot controller can be used like a device connected via PROFIBUS to the master module.



NOTE
When the directly connected and set output port is used with the program, the bit information may not become the intended value. Do not use the directly connected and set output port with the program.

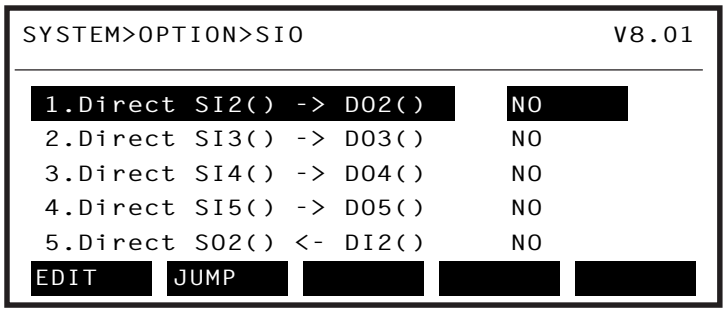
3.1 Emulated serialization setting on parallel DIO

The relation of the parallel port and serial port that can be connected is shown below.

Input device such as sensor		Output device such as valve	
DI port →	SO port	DO port ←	SI port
DI2()	SO2()	DO2()	SI2()
DI3()	SO3()	DO3()	SI3()
DI4()	SO4()	DO4()	SI4()
DI5()	SO5()	DO5()	SI5()

[Operation]

1. Press the F 3 (SIO) key in "SYSTEM > OPTION" mode.



Valid keys and submenu functions in this mode are as follows.

Valid keys	Menu	Function
the cursor keys (↑/↓)		Selects SIO parameters.
F1	EDIT	Sets SIO parameters.
F2	JUMP	Jumps to specified SIO parameter.

NOTE
When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

1. Direct connection from SI n ( ) to DO n ( )

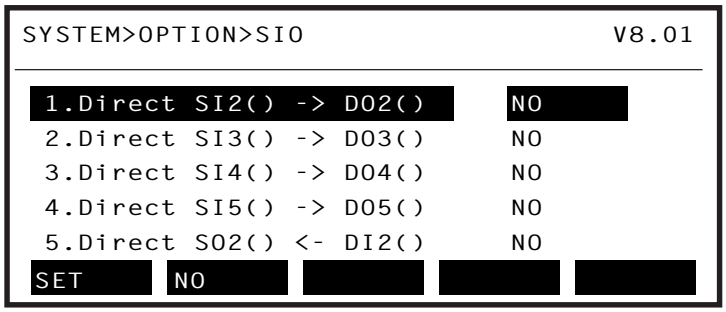
Serial port input can be directly connected to parallel port output. The relation of the parallel port and serial port that can be connected is as follows.

NOTE
When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

Output device such as sensor		
DO port	←	SI port
DO2()		SI2()
DO3()		SI3()
DO4()		SI4()
DO5()		SI5()

[Operation]

1. Select an SI port (from items 1 to 4) in the "SYSTEM > OPTION > SIO" mode.
2. Press the F 1 (EDIT) key.



3. Press the F 1 (SET) key to enable the connection or the F 2 (NO) key to cancel the setting.
4. Press the ESC key to quit setting or select another SI port with the cursor keys to continue setting.

2. Direct connection from DI n ( ) to SO n ( )

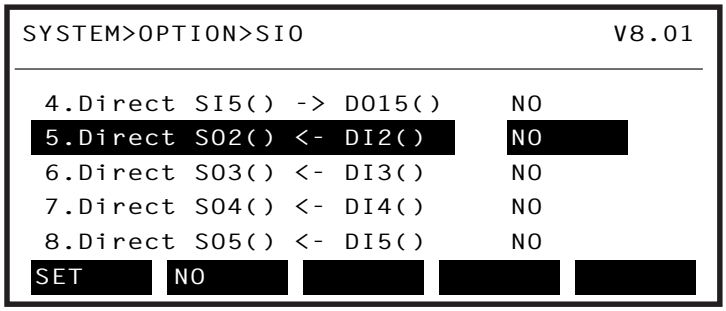
Parallel port input can be directly connected to serial port output. The relation of the parallel port and serial port that can be connected is as follows.

NOTE
When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

Input device such as valve	
DI port →	SO port
DI2()	SO2()
DI3()	SO3()
DI4()	SO4()
DI5()	SO5()

[Operation]

1. Select a DI port (from items 5 to 8) in the "SYSTEM > OPTION > SIO" mode.
2. Press the F 1 (EDIT) key.



3. Press the F 1 (SET) key to enable the connection or the F 2 (NO) key to cancel the setting.
4. Press the ESC key to quit setting or select another DI port with the cursor keys to continue setting.

4. Referring to communication data

The ON/OFF information exchanged with the master module can be referred to using the programming box (RPB for RCX22x and RCX240 or MPB for RCX14x; hereinafter called "MPB/RPB").
Note that the MPB/RPB display update interval is longer than the PROFIBUS data update interval, so if the ON/OFF interval is short, accurate information may not be displayed.

4.1 Referring to the data from the programming box

The data exchanged with the master module can be referred to with the MPB/RPB. The reference unit is the robot controller input/output port No.


```
SYSTEM                                  V8.01

SI monitor
 SI0()=&B00000111   SI4()=&B11000000
 SI1()=&B00001111   SI5()=&B00101000
 SI2()=&B00010001   SI6()=&B00000111
 SI3()=&B00000100   SI7()=&B00000000
 PARAM   CMU   OPTION   INIT   DIAGNOS
```

* &Bxxxxxxx corresponds to the 0th bit to 7th bit from right to left.

```
SYSTEM                                  V8.01

SIW monitor
 SIW(0)=&H0132      SIW(4)=&H0000
 SIW(1)=&H0001      SIW(5)=&H0000
 SIW(2)=&H8000      SIW(6)=&HFFFF
 SIW(3)=&H0000      SIW(7)=&H0000
 PARAM   CMU   OPTION   INIT   DIAGNOS
```

* &Hxxxx expresses a hexadecimal.

[Operation]

1. Press the DISPLAY key on the MPB/RPB. A screen like that shown below will appear.

```
SYSTEM                                  V8.01

DI monitor
 DI0()=&B00000111   DI4()=&B11000000
 DI1()=&B00001111   DI5()=&B00101000
 DI2()=&B00010001   DI6()=&B00000111
 DI3()=&B00000100   DI7()=&B00000000
 PARAM   CMU   OPTION   INIT   DIAGNOS
```

2. Press the DISPLAY key on the MPB/RPB several times to check the status of SI input ports 0 to 7.
3. Press the DISPLAY key on the MPB/RPB more to check the status of SI input ports 10 to 15.
4. Press the DISPLAY key on the MPB/RPB twice more to check the status of SO input ports 0 to 7.
5. Press the DISPLAY key on the MPB/RPB more to check the status of SO input ports 10 to 15.
6. Press the DISPLAY key on the MPB/RPB twice more to check the status of SIW input ports 0 to 7.

7. Press the DISPLAY key on the MPB/RPB more to check the status of SIW input ports 8 to 15.
8. Press the DISPLAY key on the MPB/RPB more to check the status of SOW output ports 0 to 7.
9. Press the DISPLAY key on the MPB/RPB more to check the status of SOW output ports 8 to 15.
10. To stop checking the input/output ports, press the ESC key.

Chapter 4 Troubleshooting

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2. Meanings of LEDs on PROFIBUS compatible module 4-2

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4. Error messages relating to PROFIBUS 4-7

MEMO

1. Items to confirm before starting up PROFIBUS system

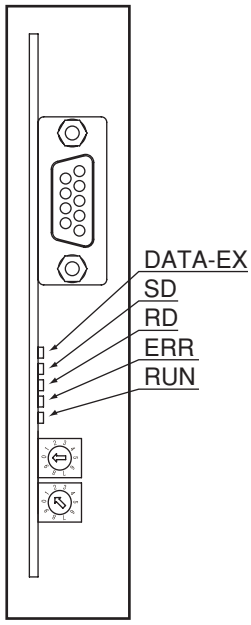
Confirm the following items before starting up the PROFIBUS system.

	Confirmation details	Check
1	Is the PROFIBUS compatible module accurately connected? (Refer to Chapter 2 section 2 or 3.)	
2	Is the robot controller set to the PROFIBUS system specifications? (Refer to Chapter 2 section 1.)	
3	Are the PROFIBUS compatible module station address correctly set? (Refer to Chapter 2 section 1.)	
4	Is the ferrite core connected to the power input cable to the robot controller? (Refer to Chapter 2 section 4.)	
5	Is the PROFIBUS system cable accurately connected to the PROFIBUS compatible module? (Refer to Chapter 2 section 5.)	
6	Was the line test from the master module correct? (Refer to the master module instruction manual.)	

NOTE

On the RCX240, the dedicated input of STD. DIO connector provided the controller will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled. On the RCX22x, the dedicated input of STD. DIO connector will be disabled, but the interlock signal (DI 11) in SAFETY connector enabled.

2. Meanings of LEDs on PROFIBUS compatible module



Front of the unit

The LEDs on the PROFIBUS compatible module express the following statuses. Use these for confirmation when an error occurs.

⚠ ***CAUTION***
After the power is turned ON, all LEDs will light for 250ms and then display an operation status as shown on the right.
If the power is not supplied to the PROFIBUS compatible module, the LEDs remain OFF even after the power is turned ON.

RUN	ERR	RD	SD	Meaning
●	●	●	●	Power is not supplied to the PROFIBUS compatible module.
○	○	●	●	PROFIBUS compatible module hardware error.
○	○	●	◎	Establishing communication.
○	○	●	○	Cannot receive data from the robot controller.
○	●	○	○	Normal communication with master module.

●: OFF, ○: ON, ◎: Blinks
* DATA-EX lights up only during normal communication with master module.

3. Troubleshooting

If trouble occurs in the connection with the robot controller while starting up the PROFIBUS system or during operation, check the following items in listed order.

3-1 Robot controller front panel LED confirmation

3-2 Programming box error display confirmation

3-3 PROFIBUS compatible module LED confirmation

3-4 Confirmation from master module

3.1 Robot controller front panel LED confirmation

[Confirmation item 1]

<Confirmation details>

- The "PWR" LED on the RCX240 is OFF.
- The "RDY" LED on the RCX22x is OFF.

<Cause>

- Power is not being supplied to the robot controller.

<Countermeasures>

- Measure the voltage at the AC power input terminal of the power connector with a multimeter and check that the rated voltage is being supplied.

* Refer to the robot controller user's manual for the rated voltage for the robot controller.

[Confirmation item 2]

<Confirmation details>

- The “ERR” LED is ON.

<Cause>

- The robot controller is in emergency stop.
- A major error has occurred in the robot controller.

<Countermeasures>

- Confirm the error message displayed on the programming box.
- Take measures by following the troubleshooting section in the robot controller user's manual.

* Refer to the robot controller user's manual for details on the errors.

3.2 Programming box error display confirmation

[Confirmation item 1]

<Confirmation details>

- Check whether an error message “PROFIBUS Link Error” or “PROFIBUS Hardware Error” is displayed on the programming box.
  These error messages may not appear for a while right after the power is turned ON, so check the error history with the “SYSTEM> DIAGNOS > HISTORY” mode.

<Cause>

- An error has occurred in the PROFIBUS system connection.

<Countermeasures>

- Check whether the PROFIBUS system cable is disconnected or miswired. Reconnect the cable correctly if disconnected or miswired.
- Check the station address setting of the PROFIBUS compatible module. Correct the address setting if incorrect.
- Check that the master module is in normal operation.
- Check the hardware configuration setting. Correct the setting if needed.

[Confirmation item 2]

<Confirmation details>

- Check whether an error other than “PROFIBUS Link Error” is displayed on the programming box. In this case, this problem is not related to the PROFIBUS system connection. Note, however, the message “PROFIBUS Link Error” may not appear on the programming box if multiple errors have occurred simultaneously.

<Cause>

- An error has occurred in the robot controller.

<Countermeasures>

- Check the error message displayed on the programming box.
- Check the error history using the programming box. Check the error history in the “SYSTEM > DIAGNOS > HISTORY” mode using the programming box.
- Take measures by following the troubleshooting section in the robot controller user's manual.

* Refer to the robot controller user's manual for details on the errors.

3.3 PROFIBUS compatible module LED confirmation

[Confirmation item 1]

<Confirmation details>

- Check that the LED display on the PROFIBUS compatible module is not “RUN: ON, ERR: OFF, RD: ON, SD: ON, DATA-EX: ON”.

<Cause>

- An error has occurred in the PROFIBUS system connection.
- Refer to table in section 2 for the meanings of the LED displays.

<Countermeasures>

- Check whether the PROFIBUS system cable is disconnected or miswired. Reconnect the cable correctly if disconnected or miswired. Also check that the termination resistor is connected.
- Check whether the PROFIBUS system cable is laid near the main circuit or power cable, or whether it is bundled with these.
- Check that the ferrite core is connected to the robot controller’s power supply cable.
- Check the station address setting of the PROFIBUS compatible module. Correct the address setting if incorrect.
- Check that the master module is in normal operation.
- Check the hardware configuration setting. Correct the setting if needed.

3.4 Confirmation from master module

[Confirmation item 1]

<Confirmation details>

- Using the master module's line test function, confirm robot controller is correctly connected to the PROFIBUS system.

* Refer to the master module instruction manual for details on the line test.

[Confirmation item 2]

<Confirmation details>

- Using the master module's line test function, check whether an error has occurred in the robot controller's PROFIBUS connection.

<Cause>

- The ferrite core for noise measures is not connected.
- The PROFIBUS cable is laid near sources of noise such as the power cable.

<Countermeasures>

- Connect the ferrite core for noise measures onto the input power cable.
- Wire the PROFIBUS cable away from noise sources such as the power cable.

4. Error messages relating to PROFIBUS

This section describes error messages relating to PROFIBUS compatible units. For other messages, refer to robot controller user's manuals.
When an error occurs, an error message appears on the message line (2nd line) of the MPB/RPB screen.

12.1 : Emg.stop on

Code : &H0C01
Meaning/Cause : a. MPB emergency stop button was pressed.
b. Emergency stop terminals on SAFETY connector are open (emergency stop status).
c. MPB or terminator is not connected to MPB connector.
d. SAFETY connector is not connected.
e. SI(00) is not ON.
f. Error in connection to PROFIBUS system.
g. RPB emergency stop button was pressed.
h. RPB or terminator is not connected to RPB connector.
Action : 1. Release the MPB emergency stop button.
2. Close the emergency stop terminals on SAFETY connector.
3. Connect MPB or terminator to MPB connector.
4. Attach the SAFETY connector.
5. Set SI(00) to ON.
6. Correct the connection to PROFIBUS system.
7. Release the RPB emergency stop button.
8. Connect RPB or terminator to RPB connector.

12.2 : Interlock on

Code : &H0C02
Meaning/Cause : a. Program was executed or moving of axis attempted with interlock signal still input.
b. Interlock signal turned ON during execution of program or axis movement.
c. DC 24V is supplied to STD.DIO connector on the RCX240 and DI(11) is not turned ON.
d. SI(11) is not ON.
e. Error in connection to PROFIBUS system.
f. DI(11) for RCX22x is not turned ON.
Action : 1. Cancel the interlock signal, and execute program or move axis.
2. Set DI(11) on STD.DIO connector to ON. (RCX240)
3. Set SI(11) to ON.
4. When not using STD.DIO, set "DC 24V monitor" of system parameters to "INVALID". (RCX240)
5. Correct the connection to PROFIBUS system.
6. Set DI(11) in SAFETY connector to ON. (RCX22x)

12.21 : PROFIBUS link error

Code : &H0C15
Meaning/Cause : a. Error in cable for PROFIBUS system.
b. Wrong station address setting for PROFIBUS system.
c. Master station sequencer power is turned off, or master station sequencer has stopped operating, is in abnormal operation or at fault.
d. The PROFIBUS compatible module is broken.
Action : 1. Check for a broken wire, disconnection, miswiring or specifications (cable length, etc.) of PROFIBUS cable.
2. Check the station address setting.
3. Check if the master station sequencer is in normal operation.
4. Check the hardware configuration setting.
5. Replace the PROFIBUS compatible module.

12.22 : PROFIBUS hardware error

Code : &H0C16
Meaning/Cause : a. The PROFIBUS compatible module is broken.
Action : 1. Replace the PROFIBUS compatible module.

12.70 : Incorrect option setting

Code : &H0C46
Meaning/Cause : a. Error in DIP switch setting on option unit.
b. Mismatched option units have been installed.
c. Cannot identify the installed option unit.
Action : 1. Check the DIP switch settings on the option unit.
2. Install the correct option units.
3. Replace the option unit.

Chapter 5 Specifications

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MEMO

⚠ ***CAUTION***
Explanations are given based on the address for the SIEMENS master module. Refer to the respective manuals when using other master module brands.

YAMAHA robot controller
Bit input/output

Slave → Master			Master → Slave		
Address	bit	Signal name	Address	bit	Signal name
Im+32	0	SO (00): Emergency stop input status output	Qn+32	0	SI (00): Emergency stop input
	1	SO (01): CPU_OK status output		1	SI (01): Servo ON input
	2	SO (02): Servo ON status output		2	SI (02): Service mode input
	3	SO (03): Alarm status output		3	SI (03): Step execution input *1
	4	System area [for future expansion]		4	System area [for future expansion]
	5			5	SI (05): IO command execution trigger input
	6			6	System area [for future expansion]
	7			7	
Im+33	0	SO (10): AUTO mode status output	Qn+33	0	SI (10): Sequence control input
	1	SO (11): Origin return complete status output		1	SI (11): Interlock input
	2	SO (12): Sequence program execution status output		2	SI (12): Robot program start input
	3	SO (13): Robot program execution status output		3	SI (13): AUTO mode input
	4	SO (14): Program reset status output		4	RCX141/221: SI (14): Absolute reset input *2
					RCX142/222: SI (14): Return-to-origin input *3
					RCX240: SI (14): Return-to-origin input
	5	SO (15): Battery alarm output *1		5	SI (15): Program reset input
	6	SO (16): IO command execution judgment output		6	SI (16): MANUAL mode input
	7	SO (17): Output during IO command execution		7	RCX141/221: SI (17): Return-to-origin input
					RCX142/222: SI (17): Absolute reset input
					RCX240: SI (17): Absolute reset input/Return-to-origin input *4
Im+34	0 to 7	SO(20) to SO(27): General-purpose output	Qn+34	0 to 7	SI(20) to SI(27): General-purpose input
Im+35	0 to 7	SO(30) to SO(37): General-purpose output	Qn+35	0 to 7	SI(30) to SI(37): General-purpose input
Im+36	0 to 7	SO(40) to SO(47): General-purpose output	Qn+36	0 to 7	SI(40) to SI(47): General-purpose input
Im+37	0 to 7	SO(50) to SO(57): General-purpose output	Qn+37	0 to 7	SI(50) to SI(57): General-purpose input
Im+38	0 to 7	SO(60) to SO(67): General-purpose output	Qn+38	0 to 7	SI(60) to SI(67): General-purpose input
Im+39	0 to 7	SO(70) to SO(77): General-purpose output	Qn+39	0 to 7	SI(70) to SI(77): General-purpose input
Im+40	0 to 7	SO(100) to SO(107): General-purpose output	Qn+40	0 to 7	SI(100) to SI(107): General-purpose input
Im+41	0 to 7	SO(110) to SO(117): General-purpose output	Qn+41	0 to 7	SI(110) to SI(117): General-purpose input
Im+42	0 to 7	SO(120) to SO(127): General-purpose output	Qn+42	0 to 7	SI(120) to SI(127): General-purpose input
Im+43	0 to 7	SO(130) to SO(137): General-purpose output	Qn+43	0 to 7	SI(130) to SI(137): General-purpose input
Im+44	0 to 7	SO(140) to SO(147): General-purpose output	Qn+44	0 to 7	SI(140) to SI(147): General-purpose input

(continued to next page)

Slave → Master			Master → Slave		
Address	bit	Signal name	Address	bit	Signal name
Im+45	0 to 7	SO(150) to SO(157): General-purpose output	Qn+45	0 to 7	SI(150) to SI(157): General-purpose input
Im+46	0 to 7	Reserved	Qn+46	0 to 7	Reserved
Im+47	0 to 7	Reserved	Qn+47	0 to 7	Reserved

I : Input address.
Q : Output address.
m, n : Start address assigned by hardware configuration.

*1: Step execution input (SI(03)) and battery alarm output (SO(15)) are only supported by the RCX22x.
*2: Used in YC-Link only when RCX141 or RCX221 is used with SR1-X.
*3: Used in YC-Link only when RCX142 or RCX222 is used with SR1-P.
*4: Used for "absolute reset" or "absolute reset / return-to-origin" depending on parameter (DI17 mode) setting.

Word input/output

Slave → Master			Master → Slave		
Address	Name		Address	Name	
Im		Dedicated SOW(0)	Qn		Dedicated SIW(0)
Im+2		Dedicated SOW(1)	Qn+2		Dedicated SIW(1)
Im+4	General-purpose	General-purpose SOW(2)	Qn+4	General-purpose	General-purpose SIW(2)
Im+6	SOD(2)	General-purpose SOW(3)	Qn+6	SID(2)	General-purpose SIW(3)
Im+8	General-purpose	General-purpose SOW(4)	Qn+8	General-purpose	General-purpose SIW(4)
Im+10	SOD(4)	General-purpose SOW(5)	Qn+10	SID(4)	General-purpose SIW(5)
Im+12	General-purpose	General-purpose SOW(6)	Qn+12	General-purpose	General-purpose SIW(6)
Im+14	SOD(6)	General-purpose SOW(7)	Qn+14	SID(6)	General-purpose SIW(7)
Im+16	General-purpose	General-purpose SOW(8)	Qn+16	General-purpose	General-purpose SIW(8)
Im+18	SOD(8)	General-purpose SOW(9)	Qn+18	SID(8)	General-purpose SIW(9)
Im+20	General-purpose	General-purpose SOW(10)	Qn+20	General-purpose	General-purpose SIW(10)
Im+22	SOD(10)	General-purpose SOW(11)	Qn+22	SID(10)	General-purpose SIW(11)
Im+24	General-purpose	General-purpose SOW(12)	Qn+24	General-purpose	General-purpose SIW(12)
Im+26	SOD(12)	General-purpose SOW(13)	Qn+26	SID(12)	General-purpose SIW(13)
Im+28	General-purpose	General-purpose SOW(14)	Qn+28	General-purpose	General-purpose SIW(14)
Im+30	SOD(14)	General-purpose SOW(15)	Qn+30	SID(14)	General-purpose SIW(15)

I : Input address.
Q : Output address.
m, n : Start address assigned by hardware configuration.

2. Details of input/output signals

CAUTION

Explanations are given based on the address for the SIEMENS master module. Refer to the respective manuals when using other master module brands.

NOTE

Battery alarm output (SO(15)) is only supported by the RCX22x.

NOTE

In controllers using the following software versions, the area check outputs can be assigned to general-purpose outputs SO(20) to SO(157) when the area check output function is used.

RCX240: Ver. 10.10 or later

RCX22x: Ver. 9.22 or later

In controllers whose software version is earlier than the above, the area check outputs can be assigned to general-purpose outputs SO(20) to SO(24).

Address	Signal name	Details
Im+32.0	SO (00): Emergency stop input status output	Turns ON when robot controller is in emergency stop state.
Im+32.1	SO (01): CPU_OK status output	Turns ON when robot controller is in normal state.
Im+32.2	SO (02): Servo ON status output	Turns ON when robot controller motor power is ON.
Im+32.3	SO (03): Alarm status output	Turns ON when robot controller is in following state: • Serious error occurred in robot controller. • Emergency stop input OFF
Im+33.0	SO (10): AUTO mode status output	Turns ON when selected mode is AUTO mode. Turns OFF when other mode is selected.
Im+33.1	SO (11): Origin return complete status output	Turns ON when robot has complete origin return.
Im+33.2	SO (12): Sequence program execution status output	Turns ON while sequence program is executed.
Im+33.3	SO (13): Robot program execution status output	Turns ON while robot program is executed.
Im+33.4	SO (14): Program reset status output	Turns ON when robot program has been reset. Turns OFF when robot program starts.
Im+33.5	SO (15): Battery alarm output	Turns ON when system backup battery (RCX22x) or absolute battery (RCX222) is low.
Im+33.6	SO (16): IO command execution judgment output	Turns OFF while executing the IO command. After executing the IO command turns ON if normal, and stays OFF if abnormal.
Im+33.7	SO (17): Output during IO command execution	Turns ON while executing the IO command.
Im+34.0 to Im+34.7	SO(20) to SO(27): General-purpose output	General-purpose output turns ON/OFF when value is substituted to SO port, or SET/RESET command or OUT command is executed.
to	to	
Im+45.0 to Im+45.7	SO(150) to SO(157): General-purpose output	

I : Input address.
m : Start address assigned by hardware configuration.

Address	Signal name		Details
Qn+32.0	SI (00): Emergency stop input		Turn OFF to trigger emergency stop on controller. Keep turned ON during normal operation.
Qn+32.1	SI (01): Servo ON input		Turn ON to cancel emergency stop and turn ON the robot servo motor. Servo-ON is executed when this input is switched from OFF to ON. Emergency stop input [SI(00)] Qn+32.0 must be ON and emergency stop condition in the robot controller (emergency stop terminal of SAFETY connector, etc.) must be canceled.
Qn+32.2	SI (02): Service mode input		Turn OFF to enter the controller in service mode. Keep turned ON during normal operation. (Effective only when SAFE mode is enabled.) (In SAFE mode enabled, dedicated input might be disabled depending on service mode parameter setting.)
Qn+32.3	SI(03): Step execution input		Turn ON to execute a step in the program during AUTO mode. One line of the program is executed when this input is changed from OFF to ON.
Qn+32.5	SI (05): IO command execution trigger input		Turn from OFF to ON to execute IO command. Always turn ON after IO command is set to general-purpose input.
Qn+33.0	SI (10): Sequence control input		Turn ON to execute sequence program in the robot controller. Sequence program is executed when this input is ON.
Qn+33.1	SI (11): Interlock input		Turn OFF to stop execution of robot program. Keep tuned ON to continue program execution.
Qn+33.2	SI (12): Robot program start input		Turn ON to execute robot program. Robot program is executed when this input is switched from OFF to ON. Robot controller must be in AUTO mode.
Qn+33.3	SI (13): AUTO mode input		Turn ON to select AUTO mode. Robot program enters AUTO mode when this input is switched from OFF to ON.
Qn+33.4	RCX141/221	SI (14): Absolute reset input * For YC-Link where RCX141/221 is used with SR1-X.	Turn ON to perform absolute reset of robot. Absolute reset is performed when this input is switched from OFF to ON, except for axes that use mark method for return-to-origin. Absolute reset cannot be performed by dedicated input if return-to-origin is incomplete on axes that use mark method. Robot controller mode must be in MANUAL mode.
	RCX142/222	SI (14): Return-to-origin input * For YC-Link where RCX142/222 is used with SR1-P.	Turn ON to perform return-to-origin on incremental type axes or semi-absolute type axes. When this input is switched from OFF to ON, return-to-origin is performed on incremental type axes or absolute search is performed on semi-absolute type axes. This input is for axes whose return-to-origin method is sensor or stroke-end (torque detection) method. Robot controller mode must be in MANUAL mode.
	RCX240	SI (14): Return-to-origin input	
Qn+33.5	SI (15): Program reset input		Turn ON to reset robot program. Program reset is executed when this input is switched from OFF to ON. Robot controller must be in AUTO mode.
Qn+33.6	SI (16): MANUAL mode input		Turn ON to select MANUAL mode. Robot program enters MANUAL mode when this input is switched from OFF to ON.

(continued to next page)

NOTE
Step execution input (SI(03)) is only supported by the RCX22x.

NOTE

- *When using SI(17) as return-to-origin input with the RCX240 which is used as a replacement for the RCX141 or RCX221, use SI(17) as "absolute reset / return-to-origin".*
- *When the RCX240 is used with a robot whose axis configuration includes absolute type, incremental type and/or semi-absolute type axes, and if SI(17) is used for "absolute reset / return-to-origin", then absolute reset is performed on the absolute reset axis each time return-to-origin is performed on the incremental type and/or semi-absolute type axes. So, if the robot axis configuration includes absolute type, incremental type and/or semi-absolute type axes, we recommend using SI (17) to perform absolute reset and SI(14) to perform return-to-origin.*
- *Return-to-origin input and absolute reset input can also be executed in AUTO mode by changing the execution level. Refer to the controller user's manual for more details.*

Address	Signal name		Details
Qn+33.7	RCX141/221	SI (17): Return-to-origin input	Turn ON to perform return-to-origin on incremental type axes or semi-absolute type axes. When this input is switched from OFF to ON, return-to-origin is performed on incremental type axes or absolute search is performed on semi-absolute type axes. This input is for axes whose return-to-origin method is sensor or stroke-end (torque detection) method. Robot controller mode must be in MANUAL mode.
	RCX142/222	SI (17): Absolute reset input	Turn ON to perform absolute reset of robot. Absolute reset is performed when this input is switched from OFF to ON, except for axes that use mark method for return-to-origin. Absolute reset cannot be performed by dedicated input if return-to-origin is incomplete on axes that use mark method. Robot controller mode must be in MANUAL mode.
	RCX240	SI (17): Absolute reset input/Return-to-origin input	Used for "absolute reset" or "absolute reset / return-to-origin" depending on parameter (DI17 mode) setting. ● When set to "ABS" (absolute reset) Turn ON to perform absolute reset of robot. Absolute reset is performed when this input is switched from OFF to ON, except for axes that use mark method for return-to-origin. Absolute reset cannot be performed by dedicated input if return-to-origin is incomplete on axes that use mark method. Robot controller mode must be in MANUAL mode. ● When set to "ABS/ORG" (absolute reset / return-to-origin) When only absolute type axes are used, switching this input from OFF to ON performs absolute reset. When only incremental type and semi-absolute type axes are used, switching this input from OFF to ON performs return-to-origin on the incremental axes and absolute search on the semi-absolute type axes. When absolute type, incremental type and semi-absolute type axes are used, absolute reset is first performed on the absolute axes and then return-to-origin is performed on the incremental type and semi-absolute type axes.
Qn+34.0 to Qn+34.7	SI(20) to SI(27): General-purpose input		Set these inputs to ON or OFF to refer to SI port values or execute WAIT command.
to	to		
Qn+45.0 to Qn+45.7	SI(150) to SI(157): General-purpose input		

Q : Output address.
n : Start address assigned by hardware configuration.

Address	Name		Details
Qn		Dedicated SIW(0)	Used as the remote command area.
Qn+2		Dedicated SIW(1)	Used as the remote command's command data area.
Qn+4	General-purpose	General-purpose SIW(2)	Used to input word or double word data from SIW or SID port. Or, used as remote command's command data area.
Qn+6	SID(2)	General-purpose SIW(3)	
Qn+8	General-purpose	General-purpose SIW(4)	
Qn+10	SID(4)	General-purpose SIW(5)	
Qn+12	General-purpose	General-purpose SIW(6)	
Qn+14	SID(6)	General-purpose SIW(7)	
Qn+16	General-purpose	General-purpose SIW(8)	
Qn+18	SID(8)	General-purpose SIW(9)	
Qn+20	General-purpose	General-purpose SIW(10)	
Qn+22	SID(10)	General-purpose SIW(11)	
Qn+24	General-purpose	General-purpose SIW(12)	
Qn+26	SID(12)	General-purpose SIW(13)	
Qn+28	General-purpose	General-purpose SIW(14)	
Qn+30	SID(14)	General-purpose SIW(15)	

Q : Output address.
n : Start address assigned by hardware configuration.

Address	Name		Details
Im		Dedicated SOW(0)	Used as remote command's status area.
Im+2		Dedicated SOW(1)	Used as remote command's error code area.
Im+4	General-purpose	General-purpose SOW(2)	Used to output word or double word data from SOW or SOD port. Or, used as remote command's response area.
Im+6	SOD(2)	General-purpose SOW(3)	
Im+8	General-purpose	General-purpose SOW(4)	
Im+10	SOD(4)	General-purpose SOW(5)	
Im+12	General-purpose	General-purpose SOW(6)	
Im+14	SOD(6)	General-purpose SOW(7)	
Im+16	General-purpose	General-purpose SOW(8)	
Im+18	SOD(8)	General-purpose SOW(9)	
Im+20	General-purpose	General-purpose SOW(10)	
Im+22	SOD(10)	General-purpose SOW(11)	
Im+24	General-purpose	General-purpose SOW(12)	
Im+26	SOD(12)	General-purpose SOW(13)	
Im+28	General-purpose	General-purpose SOW(14)	
Im+30	SOD(14)	General-purpose SOW(15)	

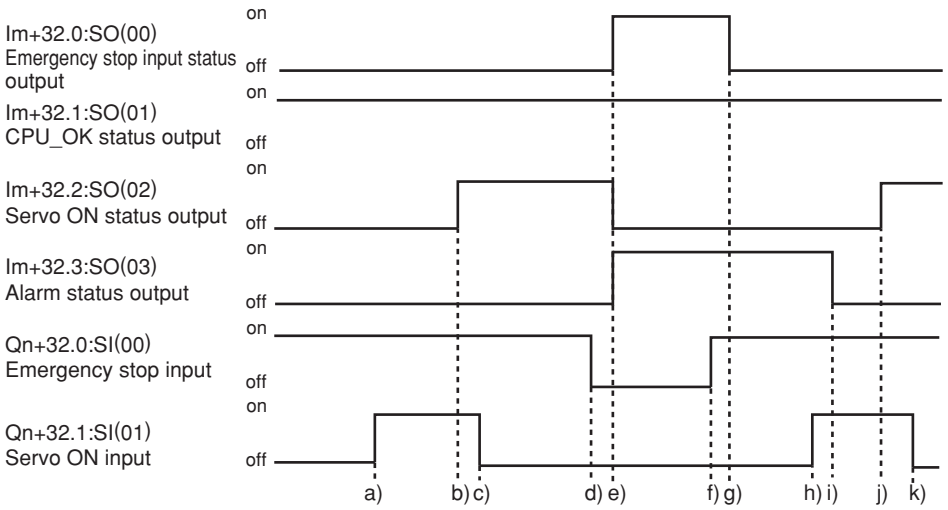
I : Input address.
m : Start address assigned by hardware configuration.

3. Dedicated input/output signal timing chart

3.1 Servo ON and emergency stop

⚠ *CAUTION*

- ***Provide an interval of 100ms or more when turning the dedicated input from the master module to the controller ON and OFF. If the interval is too short, the dedicated input may not be recognized. (This also applies to the interval for the same dedicated inputs or differing dedicated inputs.)***
- ***Use this also if there is a dedicated output in respect to the dedicated input from the master module to the controller.***



Initial servo ON process after power ON

a) Servo ON input ON is input

b) If not in the emergency stop state, output servo ON status ON is output

c) After confirming that servo ON status output is ON, servo ON input OFF is input

Shift to emergency stop

d) Emergency stop input OFF is input

e) Emergency stop input status and alarm ON status are output
Servo ON status output OFF is output

Servo ON process from emergency stop status

f) Emergency stop input ON is input

g) Emergency stop input status output OFF is output

h) Servo ON input ON is input

i) Alarm status output OFF is output

j) Servo ON status output ON is output

k) After confirming that servo ON status output is ON, servo ON input OFF is input

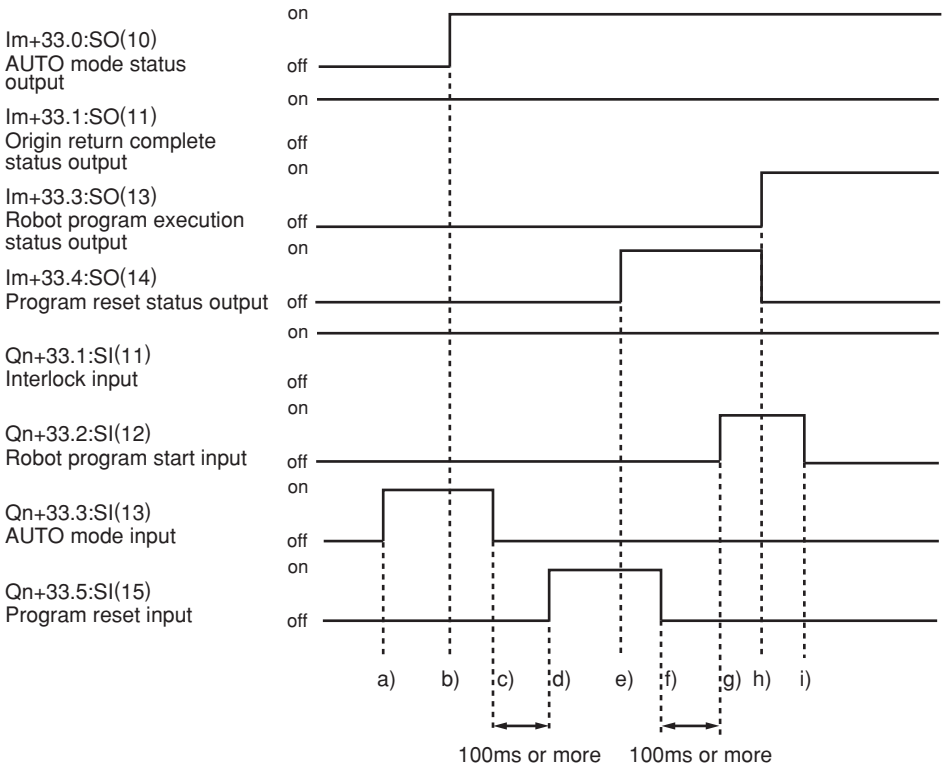
* The servo is OFF when the controller power is turned ON.

* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the PROFIBUS system.

3.2 AUTO mode changeover, program reset and program execution

⚠ *CAUTION*

- ***Provide an interval of 100ms or more when turning the dedicated input from the master module to the controller ON and OFF. If the interval is too short, the dedicated input may not be recognized. (This also applies to the interval for the same dedicated inputs or differing dedicated inputs.)***
- ***Use this also if there is a dedicated output in respect to the dedicated input from the master module to the controller.***



AUTO mode changeover process

a) AUTO mode input ON is input

b) AUTO mode status output ON is output

c) After confirming that the AUTO mode status output is ON, the AUTO mode input OFF is input

Program reset process

d) Program reset input ON is input

e) Program reset status output ON is output

f) After confirming that the program reset status output is ON, the program reset input OFF is input

Program execution process

g) Robot program start input ON is input

h) Program reset status output OFF is output

Robot program execution status output ON is output

i) After confirming that the robot program execution status output is ON, the robot program start input OFF is input

* The program cannot be executed if the emergency stop input and interlock input are OFF.

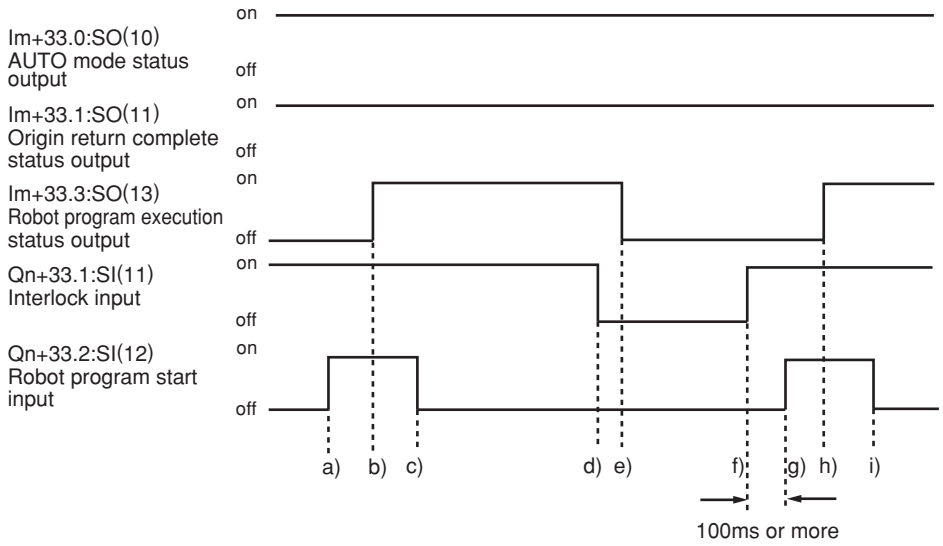
* If the origin return complete status output is not ON, execution of the program may not be possible depending on the execution level setting value.

* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the PROFIBUS system.

3.3 Stopping with program interlock

⚠ *CAUTION*

- ***Provide an interval of 100ms or more when turning the dedicated input from the master module to the controller ON and OFF. If the interval is too short, the dedicated input may not be recognized. (This also applies to the interval for the same dedicated inputs or differing dedicated inputs.)***
- ***Use this also if there is a dedicated output in respect to the dedicated input from the master module to the controller.***



Program execution process

a) Robot program start input ON is input

b) Robot program execution status output ON is output

c) After confirming that the robot program execution status output is ON, the start input OFF is input

Program stop process using interlock input

d) Interlock input OFF is input

e) Robot program execution status output OFF is output

Program execution after stopping program with interlock input

f) Interlock input ON is input

g) Robot program start input ON is input

h) Robot program execution status output ON is output

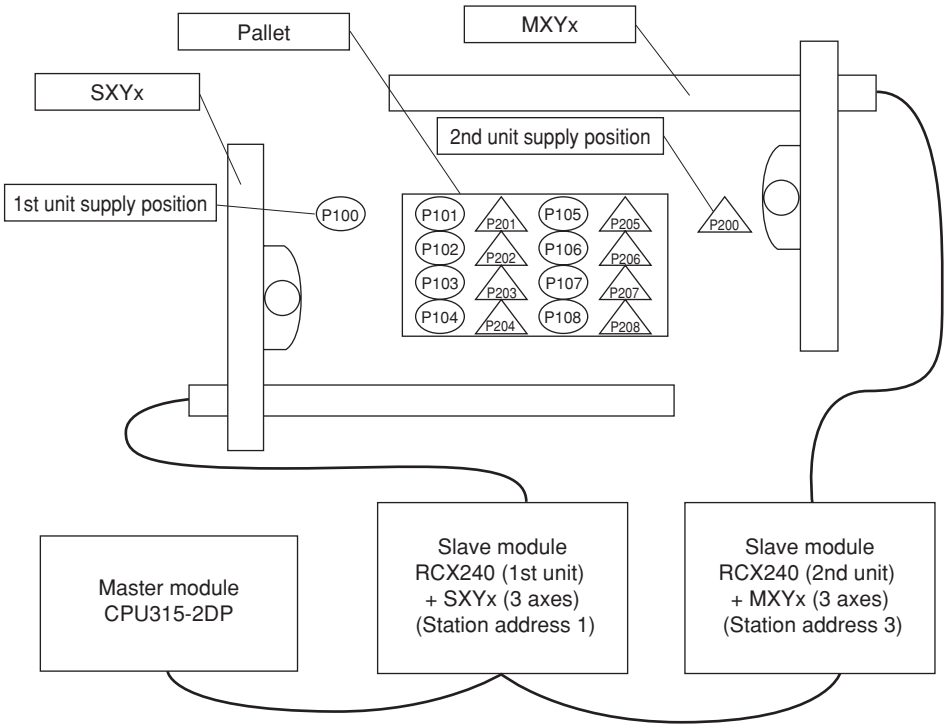
i) After confirming that the robot program execution status output is ON, the start input OFF is input

* The program will also stop when the emergency stop input OFF is input. In this case, the emergency stop input status output and alarm status output will be ON, and the servo ON status output will be OFF. The servo ON process is required to start the program again.

* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the PROFIBUS system.

4. Sample program

An example for the following type of hardware configuration has been prepared for this section.



⚠ ***CAUTION***
Explanations are given based on the address for the SIEMENS master module. Refer to the respective manuals when using other master module brands.

[Details of sample]

- Pick & place work is carried out using the PLC and RCX240 + SXYx (3 axes), RCX240+MXYx (3 axes).
- The workpieces supplied to each robot are arranged on one pallet.
- The workpiece is supplied at a rate faster than the robot operation.
- The two robots will interfere above the pallet, so data is exchanged to prevent interference.
- When handling the workpiece, the robot moves at a low speed.
- The robot controller directly exchanges the pallet.

* Refer to the robot programming manual for details on the robot program language.

* The PLC circuit is a simple circuit that executes the selected robot program when emergency stop is canceled.

[Robot program data assignment]

*** Variables used**

1st unit :	A	: Point No. in pallet
2nd unit :	B	: Point No. in pallet

*** Points used**

1st unit :	P100	: Point above workpiece supply
	P101	: 1st point above pallet
	:	:
	P108	: 8th point above pallet
	P121	: Z axis position point for workpiece supply
	P122	: Z axis position point on pallet
2nd unit :	P200	: Point above workpiece supply
	P201	: 1st point above pallet
	:	:
	P208	: 8th point above pallet
	P221	: Z axis position point for workpiece supply
	P222	: Z axis position point on pallet

*** Bit data used**

1st unit :	SI (40)	: Point No. reception complete input
	SI (41)	: Movement complete response standby input
	SI (42)	: Movement complete standby input
	SO (23) to SO (20)	: Point No. setting output group
	SO (40)	: Point No. setting complete output
	SO (41)	: Movement complete output
	SO (42)	: Movement complete response output
	DI (47)	: Pallet change complete input
	DO (40)	: Chuck hand open close (0: Close, 1: Open)
	DO (47)	: Pallet exchange command output
2nd unit :	SI (23) to SI (20)	: Point No. setting input group
	SI (40)	: Point No. transmission complete input
	SI (41)	: Movement complete standby input
	SI (42)	: Movement complete response standby input
	SO (40)	: Point No. setting reception complete output
	SO (41)	: Movement complete response output
	SO (42)	: Movement complete output
	DO (40)	: Chuck hand open/close (0: Close, 1: Open)

[PLC data assignment]

M100.0	: 1st unit's SO(00): Emergency stop input status
M100.1	: 1st unit's SO(01): CPU_OK
:	:
M115.7	: 1st unit reservation
M200.0	: 2nd unit's SO(00): Emergency stop input status
M200.1	: 2nd unit's SO(01): CPU_OK
:	:
M215.7	: 2nd unit reservation
:	:
M50.0	: 1st unit's SI(00): Emergency stop input
M50.1	: 1st unit's SI(01): Servo ON input
:	:
M65.7	: 1st unit reservation
M150.0	: 2nd unit's SI(00): Emergency stop input
M150.1	: 2nd unit's SI(01): Servo ON input
:	:
M165.7	: 2nd unit reservation

[Robot program]

1st unit's RCX240

```
'INIT ROUTINE
    RESET SO2()
    RESET SO4()
    RESET DO4()
    A=101
'MAIN ROUTINE
    MOVE P,P100,Z=0
    GOSUB *PICK
*ST1:
    MOVE P,P[A],Z=0
    GOSUB *PLACE
    MOVE P,P100,Z=0
    SO(41)=1
    WAIT SI(41)=1
    SO(41)=0
    WAIT SI(41)=0
    SO(23,22,21,20)=A-100
    SO(40)=1
    WAIT SI(40)=1
    SO(40)=0
    WAIT SI(40)=0
    SO(23,22,21,20)=0
    GOSUB *PICK
    WAIT SI(42)=1
    SO(42)=1
    WAIT SI(42)=0
    SO(42)=0
    A=A+1
    IF A>108 THEN
      A=101
      DO(47)=1
      WAIT DI(47)=1
      DO(47)=0
    ENDIF
    GOTO *ST1
    HALT
'SUB ROUTINE FOR PICK
*PICK:
    DO(40)=1
    DRIVE(3,P121),S=20
    WAIT ARM(3)
    DO(40)=0
    DELAY 500
    RETURN
'SUB ROUTINE FOR PLACE
*PLACE:
    DRIVE(3,P122),S=20
    WAIT ARM(3)
    DO(40)=1
    DELAY 500
    RETURN
```

2nd unit's RCX240

```
'INIT ROUTINE
    RESET SO2()
    RESET SO4()
    RESET DO4()
    B=201
'MAIN ROUTINE
    MOVE P,P200,Z=0
    GOSUB *PICK
*ST2:
    WAIT SI(41)=1
    SO(41)=1
    WAIT SI(41)=0
    SO(41)=0
    WAIT SI(40)=1
    B=SI(23,22,21,20)
    SO(40)=1
    WAIT SI(40)=0
    SO(40)=0
    B=B+200
    MOVE P,P[B],Z=0
    GOSUB *PLACE
    MOVE P,P200,Z=0
    SO(42)=1
    WAIT SI(42)=1
    SO(42)=0
    WAIT SI(42)=0
    GOSUB *PICK
    GOTO *ST2
    HALT
'SUB ROUTINE FOR PICK
*PICK:
    DO(40)=1
    DRIVE(3,P221),S=20
    WAIT ARM(3)
    DO(40)=0
    DELAY 500
    RETURN
'SUB ROUTINE FOR PLACE
*PLACE:
    DRIVE(3,P222),S=20
    WAIT ARM(3)
    DO(40)=1
    DELAY 500
    RETURN
```

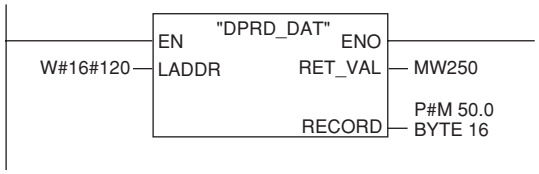
[PLC program]

Block : 0B1 "Main Program Sweep (Cycle)"

Sample program

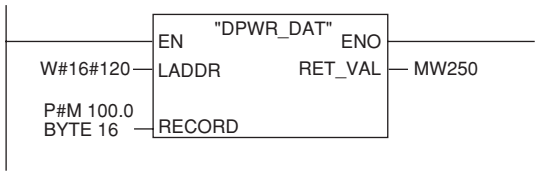
Network : 1

First device: Stores data of 16 bytes into internal memory 50 from input byte address 288.



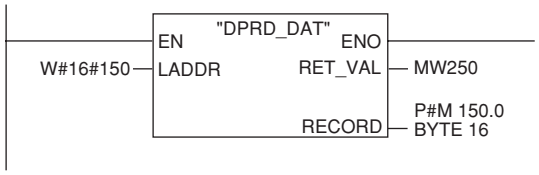
Network : 2

First device: Outputs data of 16 bytes to output byte address 288 from internal memory address 100.



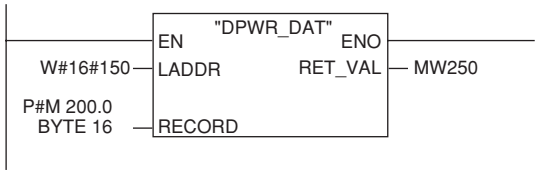
Network : 3

Second device: Stores data of 16 bytes into internal memory 150 from input byte address 336.



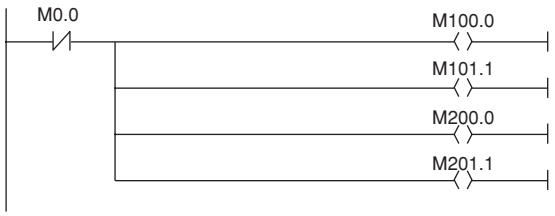
Network : 4

Second device: Outputs data of 16 bytes to output byte address 336 from internal memory address 200.



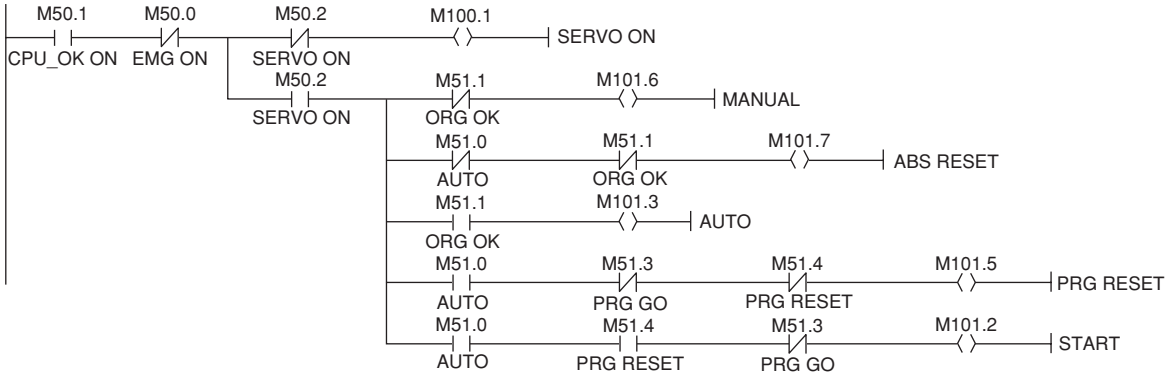
Network : 5

First and second devices: Emergency stop signal input / interlock input ON.



Network : 6

First device: Starts automatic operation after canceling emergency stop.



Network : 7

User application

Network : 8

User application

Network : 9

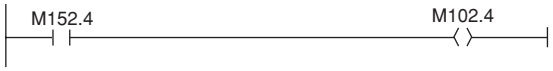
User application

Network : 10

User application

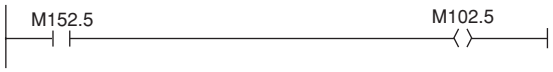
Network : 11

User application



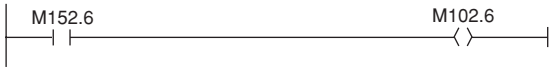
Network : 12

User application



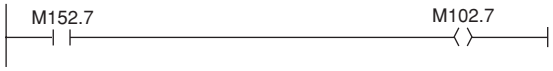
Network : 13

User application



Network : 14

User application



Network : 15

User application

Network : 16

User application

Network : 17

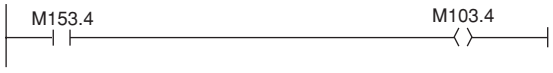
User application

Network : 18

User application

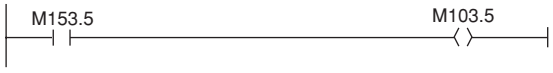
Network : 19

User application



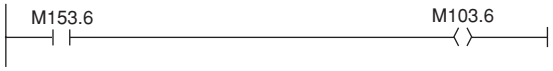
Network : 20

User application



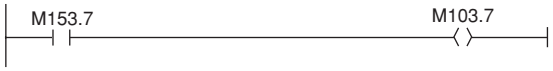
Network : 21

User application



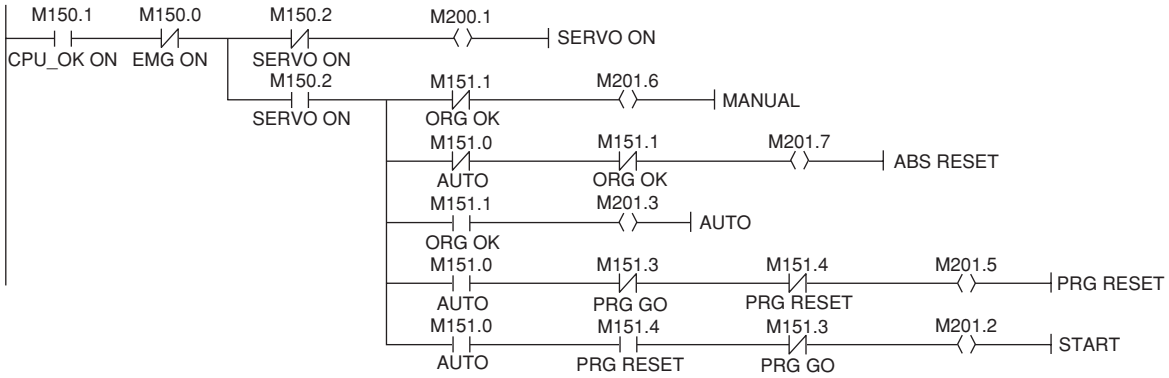
Network : 22

User application



Network : 23

Second device: Starts automatic operation after canceling emergency stop.



Network : 24

User application

Network : 25

User application

Network : 26

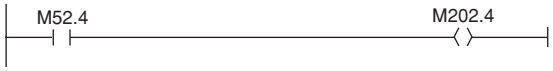
User application

Network : 27

User application

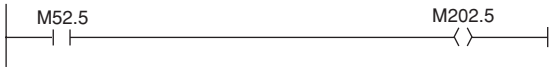
Network : 28

User application



Network : 29

User application



Network : 30

User application

Network : 31

User application

Network : 32

User application

Network : 33

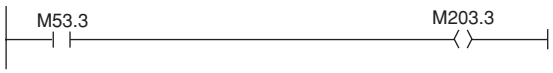
User application

Network : 34

User application

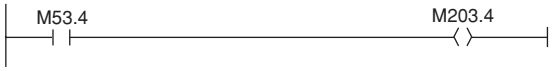
Network : 35

User application



Network : 36

User application



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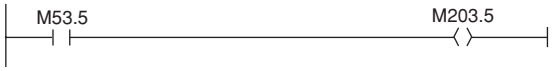
User application



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User application

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User application

5. PROFIBUS compatible module specifications

Model / Spec. Item	PROFIBUS Unit		
Controller models	RCX series controller		
Communication profile	PROFIBUS-DP slave		
Number of nodes used	1 node		
Station address setting	1 to 99 (Set with rotary switch on board)		
Transmission speed	9.6K/19.2K/93.75K/187.5K/500K/1.5M/3M/6M/12Mbps (Communication speed is automatically recognized.)		
PROFIBUS I/O points *1) (48 byte fixed data length)	Input (Total 48 bytes)	byte 0-3	Dedicated word input : 2 words
		byte 4-31	General purpose word input : 14 words
		byte 32-33	Dedicated bit input : 16 points
		byte 34-47	General purpose bit input : 96 points
	Output (Total 48 bytes)	byte 0-3	Dedicated word output : 2 words
		byte 4-31	General purpose word output : 14 words
		byte 32-33	Dedicated bit output : 16 points
		byte 34-47	General purpose bit output : 96 points
Parallel external I/O	The master module and up to four ports can be controlled regardless of the robot program by using the pseudoserialization function.		
Network Topology	9.6K/19.2K/93.75K : 1200m 187.5K : 1000m 500K : 400m 1.5M : 200m 3M/6M/12M : 100m		
Monitor LED	RUN, ERR, SD, RD, DATA-EX		

*1) Controller's I/O update intervals are 10ms at shortest, but actual I/O update intervals change depending on the update time for the master station.

⚠ ***CAUTION***
For the names and description of word and bit input/output signals, refer to the tables shown in "1. Profile" and 2. Details of input/ output signals" in this chapter.

⚠ ***CAUTION***
The specifications and appearance are subject to change without prior notice.

Chapter 6 Appendix

Contents

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MEMO

1. Term definition

1. PROFIBUS-DP

PROFIBUS-DP (Decentralized Periphery) enables high-speed data transmission between the controller and a field device such as a remote I/O device and drive.

2. SAFE mode setting

When the SAFE mode setting is enabled, service mode input is made valid so that safety functions such as operating speed limits in MANUAL mode can be used. The SAFE mode setting is determined at the time of shipping.
The SAFE mode setting is always enabled for controllers compatible with CE marking.

3. SERVICE mode

This mode is valid only when the SAFE mode setting is enabled, and can be controlled by service mode input signals.

4. SAFETY connector

This connector is used to connect emergency stop input and service mode input. Located on the front panel of the robot controller.

5. STD. DIO connector

This connector is used to receive or output dedicated I/O signals and general-purpose I/O signals. Located on the front panel of the robot controller.

6. Station address

Identification number assigned to each node in PROFIBUS.

7. Bit information

Bit information that can be handled by PROFIBUS compatible module.

8. Word information

Word information that can be handled by PROFIBUS compatible module.

9. Little endian

Method to substitute LSB in low-order address and refer to LSB when handling word information data as double word data.
For example, when the value 00012345h is substituted in SOD (2), 2345h is substituted in SOW (2) of the first word, and 0001h is substituted in SOW (3) of the second word.

```
#Profibus_DP
GSD_Revision          = 1                                    ; GSD file revision Ver1.0

Vendor_Name           = "YAMAHA MOTOR CO.,LTD."              ; Vendor name
Model_Name            = "YAMAHA ROBOT RCX"                   ; Model type
Ident_Number          = 0x06F9                               ; Identification number

FMS_supp              = 0                                    ; FMS Not Supported
Protocol_Ident        = 0                                    ; Profibus-DP Supported
Station_Type          = 0                                    ; Station = DP-Slave
Slave_Family          = 5                                    ; Slave family = Controllers

Revision              = "Ver1.0"                             ; Device revision Ver1.0
Hardware_Release      = "Ver1.0"                             ; Hardware revision Ver1.0
Software_Release      = "Ver1.0"                             ; Software revision Ver1.0

Implementation_type   = "SPC3"                               ; SPC3 ASIC
Redundancy            = 0                                    ; Not Supported
Repeater_Ctrl_Sig     = 0                                    ; Not Supported
24V_Pins              = 0                                    ; Not Supported

Auto_Baud_supp        = 1                                    ; Supported

9.6_supp              = 1                                    ; 9.6kbps
19.2_supp             = 1                                    ; 19.2kbps
93.75_supp            = 1                                    ; 93.75kbps
187.5_supp            = 1                                    ; 187.5kbps
500_supp              = 1                                    ; 500kbps
1.5M_supp             = 1                                    ; 1.5Mbps
3M_supp               = 1                                    ; 3Mbps
6M_supp               = 1                                    ; 6Mbps
12M_supp              = 1                                    ; 12Mbps
                                                             ; Max. response times:
MaxTsdr_9.6           = 60                                   ; 60Tbit = 6.25msec
MaxTsdr_19.2          = 60                                   ; 60Tbit = 3.125msec
MaxTsdr_93.75         = 60                                   ; 60Tbit = 640usec
MaxTsdr_187.5         = 60                                   ; 60Tbit = 320usec
MaxTsdr_500           = 100                                  ; 100Tbit = 200usec
MaxTsdr_1.5M          = 150                                  ; 150Tbit = 100usec
MaxTsdr_3M            = 250                                  ; 250Tbit = 83usec
MaxTsdr_6M            = 450                                  ; 450Tbit = 75usec
MaxTsdr_12M           = 800                                  ; 800Tbit = 67usec

Min_Slave_Intervall   = 1                                    ; 100usec

Set_Slave_Add_supp    = 0                                    ; Not Supported
Freeze_Mode_supp      = 0                                    ; Not Supported
Sync_Mode_supp        = 0                                    ; Not Supported
Fail_Safe             = 0                                    ; Not Supported

Modular_Station       = 1                                    ; Modular station
Max_Module            = 1                                    ; Max Module

Max_Input_Len         = 48                                   ; Maximum of input bytes
Max_Output_Len        = 48                                   ; Maximum of output bytes
Max_Data_Len          = 96                                   ; Maximum of data bytes

Max_Diag_Data_Len     = 6                                    ; Maximum diagnostic length

Module                = "Remort 16word/DI DO 16byte" 0xFF,0xBF ;
EndModule
```

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Revision record

Manual version	Issue date	Description
Ver. 1.04	Sep. 2007	Some modifications were made to support RCX22 series (addition of dedicated input/output signal, etc.). Addition of descriptions regarding semi-absolute type axes. Clerical error corrections, etc.
Ver. 1.05	Aug. 2009	Addition of descriptions regarding RCX240 to SI(17), SI(14) in Chapter 5 "1. Profile". Wording of controller name was changed, etc.
Ver. 1.06	Jun. 2011	The description regarding "Warranty" was changed.
Ver. 1.07	Jul. 2012	The description regarding "Warranty" was changed.

User's Manual

RCX series

YAMAHA Robot Controller **PROFIBUS** network board

Jul. 2012
Ver. 1.07
This manual is based on Ver. 1.07 of Japanese manual.

YAMAHA MOTOR CO., LTD. IM Operations

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